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A BIOLOGICAL MONITORING SURVEY OF REEF BIOTA WITHIN BATHURST CHANNEL, SOUTHWEST TASMANIA 2010

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Executive Summary

The benthic reef communities of Bathurst Channel represent an important feature for the ongoing management of Tasmania's marine ecology and diversity. Containing a number of fragile deep-water invertebrate species growing at accessibly shallow depths, the reef habitats are both susceptible to impacts and of scientific importance. The foundation for this study was the continuing need for a practical, quantitative monitoring program which will provide information on species composition, species distribution throughout the channel, and detect any changes occurring over time. The survey, conducted in March 2010, collected digital image data from depth intervals ranging from the intertidal zone to 20 metres depth at 13 monitoring sites extending throughout Bathurst channel, and compared it to baseline imagery taken in 2002. The high resolution imagery collected in 2010 was used to create a descriptive catalogue of the biota observed, which can be used for future monitoring and species referencing. Species and substrate percentage cover in the photos was analysed using an easily repeatable point count method (CPC*e*) where data files can be stored and reanalysed.

The information collected described the changes in species composition along Bathurst Channel, and thus provided some insight into the relevant environmental and biological factors limiting the distribution of algal and invertebrate species throughout the estuary. Results were consistent with previous descriptions of the community types within the Channel, showing that this system is inherently stable over these time frames. Patterns in assemblage distribution reflected strong species' responses to gradients in tannin levels and salinity throughout the estuary, distance from the ocean and the strength of currents/mixing. Percentage abundances of key species and species groupings (e.g. lace bryozoans) between 2002 and 2010 data were also comparable, albeit with a few differences resulting from an improvement in image quality between surveys. One notable change was an apparent 50% decline in sea whip abundance at both Munday Island and Forrester Point at 5 metres depth. This is presumed to be a consequence of drought conditions leading up to the 2010 survey, reducing the tannin concentration to a point where algal growth became possible in this zone, smothering components of the invertebrate fauna. Ongoing monitoring will enable recovery rates to be determined, and improve our understanding of the natural variability of these fragile assemblages in a changing climate. The decline in sea whip numbers does indicate that there is a delicate balance between invertebrates and algae in the lower photic zone within the Channel, one that corresponds with the depth occupied by many fragile invertebrate species, and that this balance could be significantly altered under climate change scenarios that relate to reduced rainfall. Due to new image analysis protocols established during this study, and the development of high resolution digital photography since 2002, further surveys and analysis of data will now be more easily comparable using the same sites, depths, and the methods of analysis as established here. This will allow for the successful provision of reliable monitoring data to feed into ongoing management and conservation of the unique ecosystems found in Bathurst Channel.

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1. Introduction

Bathurst Channel has been formally protected within the Port Davey Marine Reserve since 2005, and is recognized as a unique and unspoiled environment containing a highly distinctive and fragile assemblage of marine flora and fauna (Edgar *et al.*, 2010). Previous biodiversity surveys conducted in the area have found; a relatively large component of undescribed species, including numerous endemic species not recorded elsewhere (Edgar *et al.*, 2010), an extremely low number of introduced marine species (Hirst *et al.*, 2007), and a unique marine invertebrate assemblage which includes species found outside their previously recorded depth distributions (Barrett *et al.*, 2002; Barrett and Edgar, 2010). The area is of exceptional conservation value for marine biodiversity in Australia and is situated within one of only three temperate wilderness areas in the Southern Hemisphere (along with south western New Zealand and southern America), Tasmania's Southwest National Park (Edgar *et al.*, 2010). The remoteness of the area has meant that the marine environment has largely remained unaltered throughout history and is arguably one of the most pristine in southern Australia.

The marine invertebrate communities found in Bathurst Channel are particularly notable in containing a mixture of biota typical of both estuarine and deep and shallow marine ecosystems (Barrett *et al.*, 2002). The distinctive benthic assemblages are influenced by the anomalous environmental conditions and fiord-like geomorphology of the wider estuary, which stretches from Bathurst Harbour, through Bathurst Channel and out to Port Davey (Barrett and Edgar, 2010). Within the channel area there is: (i) an intense restriction of light penetration in the water column due to the influx of severely tannin stained freshwater runoff, (ii) very low levels of nutrients and a low aquatic productivity of the marine ecosystem due to the nutrient poor soils and minimal pollution in the catchment area, (iii) strong stratification of the water column with episodic periods of very low salinity at shallow depths, (iv) small tidal influences with stable temperature conditions at depth (Edgar *et al.*, 2010). Previous surveys found the low-light underwater environment to restrict the growth of large kelp species to depths generally shallower than 5 metres, allowing the deep-water emergence of marine invertebrates such as soft corals, sea whips, and sea pens to unusually shallow depths of 3 - 10 m, where as some such species have not been recorded elsewhere in depths of less than 40 m (Barrett and Edgar, 2010; Edgar and Barrett, 2010; Edgar *et al.*, 2010). In addition, the restriction of habitat forming macroalgae has coincided with an unusually low abundance of common marine groups such as echinoderms, molluscs and crustaceans, which are normally associated with productive shallow reef habitats. The resulting faunal assemblage, which is dominated by filter-feeding species as opposed to light fixing producers, is thought to be unique within the entire coastal zone of Australia, with the only other documented assemblage of similarity being found in Fjordland, New Zealand, where the waters are also strongly tannin stained (Barrett *et al.*, 2002). Environmental variation along the Bathurst Channel, from the sheltered brackish harbour to the marine influenced Port Davey, has meant that unique faunal assemblages exist at different sites, with the dominant invertebrates changing according to differences in the intensity of light restriction, salinity, food availability and water movement along the Channel.

The marine communities of Bathurst Channel are of high conservation value, yet are also presumably sensitive to human impact. The lack of many introduced marine pests along with the fragile nature of the sessile marine invertebrates found in the Channel area, and the faunal assemblages' adaptation to a low nutrient estuarine environment, indicates the potential for significant changes in the absence of ongoing management of the area. Currently no fishing is

allowed within the Bathurst Channel, anchoring is also restricted, and 3 sites (at Munday Island, Little Woody Island and Farrell Point) are assigned as scientific reference areas where no recreational diving is allowed. However, with increasing recreational visitation rates to the area, there remain potential impacts from nutrient waste, disturbance by divers, mechanical damage due to boating, global climate change, and the establishment of introduced species. There is a strong imperative to undertake monitoring and assessment of the marine benthic ecosystems within the Bathurst Channel area at appropriate time intervals, so that any changes in the assemblages can be detected and appropriately managed.

A number of studies have provided baseline information on species and habitat distribution though out the Bathurst Channel system. These include ecological surveys and collections dating back to the 1980s, as well as quantitative descriptions of aquatic biodiversity and assessments for MPA zoning (Resource Planning and Development Commission, 2003; Barrett *et al.*, 1998; Barrett and Edgar, 2010; Edgar, 1991a; Edgar, 1991b; Edgar and Cresswell, 1991), and habitat mapping (Barrett *et al.*, 2002). In particular, a quantitative baseline survey of reef biota was undertaken in 2002 by the staff of the Tasmanian Aquaculture and Fisheries Institute (now IMAS) which used digital imagery to quantify the cover of algae and sessile invertebrates at a number of locations and depths (Barrett *et al.*, 2002). Nine sites were surveyed and digital imagery was collected using a Sony TRV 900 digital video camera, with still frame images later extracted for analysis of the distribution of invertebrate and algal assemblages. These sites were distributed throughout Bathurst Channel from the entrance to Port Davey (the most exposed, marine sites) to the narrow section in the east (the most freshwater/tannin affected sites). Results provided information on the horizontal and vertical zonation and abundance of the benthic assemblages throughout Bathurst Channel. Recommendations included the periodic continuation of such baseline monitoring.

This report presents the results from an additional monitoring survey, conducted in 2010, which aimed to:

i) Collect high resolution image data from the same baseline sites established in 2002, and employ the use of updated methods for analysis of these images
ii) Establish a reference set of photos and descriptions of the biota observed,
iii) Provide further monitoring information on the composition of benthic communities at baseline sites and
iv) Detect any obvious changes in the abundance of key species and patterns throughout the system since 2002.

Following significant improvements in the equipment available for underwater photography, the quality of the imagery that can be collected is markedly higher than in 2002. In addition, the development of clearly defined, referenced, and easily repeatable methods to process imagery is seen as an important step in maintaining the provision of informative, comparable and accurate biological monitoring information into the future.

2. Methods

2.1 Data collection

This study has continued the biological monitoring of the Bathurst Channel area by the collection of digital photo-quadrats of the reef benthos along transects, as was done in 2002. This method of data collection was considered a cost effective approach which provided an adequate level of data resolution for biological monitoring, whilst also providing permanent photo records for future reference. All data collection was undertaken by staff of IMAS from the research vessel *Challenger/Odalisque/The Schouten Pass* during March 2010.

All 12 previous sites monitored in 2002 were resurveyed, with the addition of a new site at Farrell Point (Figure 2.1), an additional transect at Breaksea Island, and the exclusion of transect 1 and 2 at Eve Point. The inclusion of 2 transects at Farrell Point was due to its current status as a reference area within the Port Davey Marine Protected Area, where no diving, anchoring or fishing is allowed (along with Little Woody Island and Munday Island). Each site was referenced by GPS coordinates. The area surveyed includes sites extending from the western, most marine section of the Bathurst Channel system at Breaksea Island in the entrance Port Davey, to the eastern end of the channel at Platypus Point, in "the narrows" before the channel widens up into Bathurst Harbour. An additional transect was also completed at Breaksea Island.

Image data was collected in the form of still photographs taken at depth intervals along transects which ran perpendicular to the shore, extending from the intertidal zone down to beyond the reefs edge or to 20 m maximum depth if that came first. This meant that the length of each transect varied according to the slope of the reef bottom and its depth extent. After the transect line was deployed, a diver swam along the line stopping at defined depths to take photos in an area close to the line whilst maintaining the depth contour. The depth of each photo-quadrat swim was indicated by the diver photographing an appropriate number of fingers in front of the camera. A Canon EOS7D camera and Ikelite DS161 strobe, capable of taking high resolution (18 Mb) photographs, was used to take the photo-quadrats by swimming above the reef bottom and capturing an area of approximately 50 X 50 cm in each image (0.25m^2 photoquadrat area). While the total area within each photo-quadrat is variable due to the inability of the diver to maintain an exact fixed distance from the substrate, the use of percentage cover as an index of abundance in the analyses of the photos means that scale is relatively unimportant, as long as a suitable area is searched at each depth, there is sufficient replication, and objects were not generally too distant to be identified. Some above-water reference images were also taken at each site to capture the shoreline structure and intertidal zone. Between 1 and 3 transects were completed at each site. The number of images taken and analysed at each transect and depth interval is described in Table 2.1.

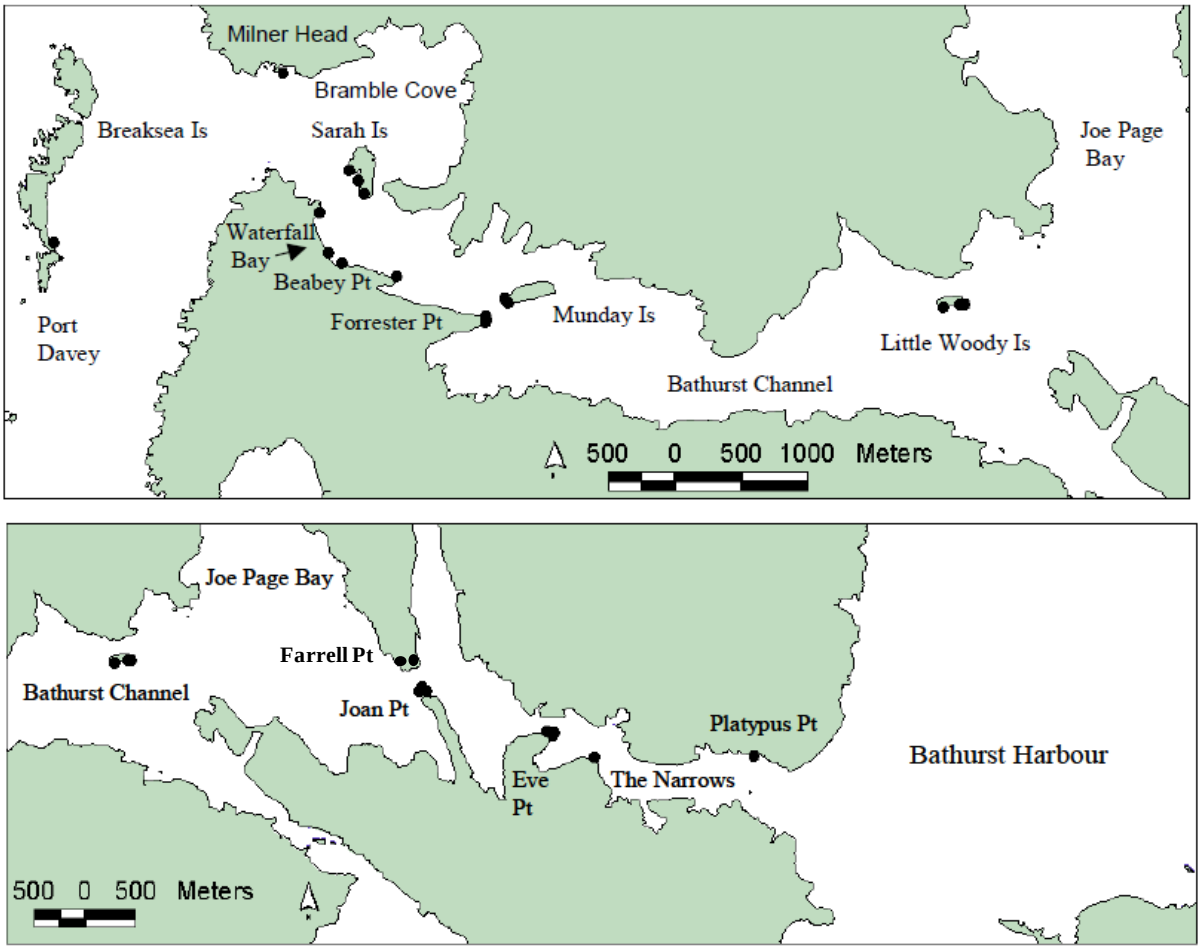

Figure 2.1 The location of transects completed in 2010 throughout the Bathurst Channel marine reserve.

2.2 Data processing

Almost 3000 images were collected in the field which were later catalogued and prepared for analyses in CPCe (Coral Point Count with excel extension). All of the images required enhancement before processing in CPCe to improve colour balance, due to the high levels of tannins in the water. For each transect, a copy of the entire folder was created and batch image enhancement was undertaken using the program XnView.

CPCe is a software that allows the determination of benthic cover using transect photographs, whereby a specified number of points are overlaid on each image and the features underlying those points are identified by the user (Kohler and Gill, 2006). In this instance a uniform grid of points were overlaid on each image and 50 points were analysed per photo, with the site, transect, depth, and dominant substrate of the photo also recorded. This resembles the 50 point 0.5m^2 quadrat used for *in situ* benthic surveys conducted in marine protected areas in Tasmania by IMAS staff. For CPCe, a code file must be constructed by the user with species/classification codes appropriate for the analyses. The code file used in this survey was based on species classifications from the 2002 survey, with provisions made for the detection of new species. All invertebrates, substrate types, substrate cover types (e.g. algal turf), and macroalgae were identified to the lowest possible taxonomic level. In many cases benthos could not be classified to species level, in which case they were placed in the corresponding category from 2002, or a new biota category. When these categories were not previously specified in the CPCe code, they were referenced as "NEW" in CPCe, and the classification information was stored in an additional data Microsoft Excel spread sheet. For reference, these new categories of biota, as well as species identified that were not previously specified in the CPCe code, were recorded in a "New Biota" catalogue, and in the full species

catalogue for the analysis. Life forms not identified to species were described by a morphological group, a number and any additional descriptive information (e.g. "Massive sponge 13 grey and holey") and catalogued along with a reference image. Since there are potentially more undescribed species of invertebrates existing in the area, during the processing of data emphasis was given to separating morphological differences in sponges, bryozoans, and ascidians rather than lumping them into one category when analysing photo data, so that these may be referenced to any possible future findings from detailed taxonomic collections/surveys. However, for the presentation of data, sponges have been categorised into the forms: arborescent, encrusting, cup, lumpy, massive, golfball, tubular and papillate.

Due to time and budget constraints, not all image files were analysed, however a minimum of 5 replicates were analysed for each site, transect and depth combination. More than 5 replicates were analysed at key sites identified from 2002 surveys, which had significant diversity or a high cover of invertebrates of interest. These included the sea whip band at Munday Island and Forrester Point, all transects at Sarah Island (depths 0.5-20 m), selected depths at Little Woody Island, and 1 – 2 m depths in the Eve Point area. After the analyses of images, the CPCe files were saved and output Microsoft Excel files were generated for each transect (27 in total). Percentage cover of each species category in each image and transect were then calculated in Excel. Excel was also used to calculate site and transect level averages and standard error values for percentage cover of species and groups of species. For comparisons with percentage cover data from 2002, the data was binned into depth ranges; 0-0.9 m, 1-1.9 m, 2-4.9 m, 5-7.9 m, 8-10.9 m, 11-15.9 m and 16-25 m. Although this meant that percentage covers for certain species that occurred at a particular depth (such as sea whips at 5m) were lower, it was necessary as not all the same depths were surveyed across both years.

Community patterns were explored in Primer using square-root transformed percentage cover data and bray-curtis resemblage matrices to generate MDS plots. For these analyses of community level patterns, the data were grouped into broader morphological categories of sponges, ascidians (encrusting, colonial, solitary), and bryozoans (lace, branching, soft, encrusting), whilst algal data were retained to species level because accurate species level identification was nearly always possible with algae, they were the dominant life form in shallow at most sites, and several algal species responded clearly to changes environmental gradients.

Table 2.1 Summary of the number of images taken, and number analysed (in brackets), within each depth category for each transect site.

Survey Day & Date	Site Name	Depth surveyed (m)																	
		0	0—0.5	0.5	1	2	3	5	5.6	6.0	6.1	6.5	7.5	8	10	10.5	13.7	15	20
Day 1 - 24/03/2010	Platypus Point	5		11(5)	10(5)	11(5)		10(5)							10(5)			11(5)	14(5)
	Point East of Eve Point	3		10(5)	11(5)	15(5)		15(5)										15(5)	15(5)
	Eve Point T4 End Of Point	3		7(5)	15(10)	10(10)		12(5)							16(5)			17(5)	15(5)
	Eve Point T3	3		11(5)	14(10)	10(9)		15(5)							14(5)			11(5)	14(5)
Day 2 - 25/03/2010	Joan Point T3	4		7(5)	10(5)	14(5)		15(5)							16(5)			17(5)	19(5)
	Joan Point T2	3		10(5)	10(5)	15(5)	10(5)	16(5)							13(5)			15(5)	16(5)
	Farrell Point West T1	3		9(5)	15(5)	19(5)	15(5)	16(5)							17(5)			21(5)	22(5)
	Farrell Point East T2	4		5(4)	17(5)	15(5)	10(5)	15(5)							15(5)			18(5)	18(5)
	Little Woody T1	5	9(5)	11(5)	16(5)	17(5)	12(10)	20(5)							16(5)			23(11)	15(5)
	Little Woody T2	4	8(5)	11(5)	16(5)	16(5)	17(5)	20(5)							16(5)			10(5)	
Day 3 - 26/03/2010	Munday Island T1	5	7(5)	10(5)	15(5)	13(5)	6(5)	15(13)							20(5)			17(5)	
	Munday Island T2	5	8(5)	10(5)	15(5)	18(5)	11(5)	23(21)							20(5)			14(5)	19(5)
	Forrester Point T1	3	10(5)		13(5)	15(5)		18(13)							19(5)			10(5)	10(5)
	Forrester Point T2	3	8(5)	10(5)	13(5)	11(5)	12(5)	17(16)							21(5)			18(5)	19(5)
	Forrester Point T3	4	7(5)	10(5)	16(5)	26(5)		18(5)							15(5)			18(5)	
	Beabey Point	3	10(5)	13(5)	19(5)	15(5)	11(5)	27(5)							15(5)			23(5)	
Day 4 – 27/03/2010	Sarah Island T1	3		6(5)	14(11)	16(10)		16(10)							17(10)			17(10)	27(10)
	Sarah Island T2	3		10(5)	15(11)	15(11)	15(10)	21(10)							21(10)			15(10)	14(10)
	Sarah Island T3	3		9(5)	20(11)	17(10)	11(10)	17(10)							17(10)			16(11)	22(10)
	Breaksea Island T1	3		10(5)	7(5)	13(5)		15(5)							11(5)				
	Breaksea Island T2	3		5(5)	10(5)	14(5)	10(5)	15(5)							16(5)				
	Turnbull Head	2		8(5)	14(5)		15(5)	16(5)							15(5)				
	Waterfall Bay T1	3		14(5)	13(5)	15(5)	10(5)	15(5)				15(5)	18(5)						
Day 5- 28/03/2010	Waterfall Bay T2	3		16(5)	15(5)	15(5)	17(5)	20(5)	21(5)	22(5)	15(5)					20(5)			
	Waterfall Bay T3	4		13(5)	15(5)	15(5)		18(5)					15(5)	31(5)					
	Little Woody T3	5		12(5)	7(5)	15(5)	15(5)	17(5)							17(5)		14(5)		
	Joan Point T1	10		10(5)	15(5)	15(5)	13(5)	17(5)							19(5)			17(5)	24(5)

3. Results

3.1 Diversity and community composition within Bathurst Channel

The images collected were mostly of good resolution despite the dark tannin-stained water, and were a vast improvement on the quality of images collected in 2002. From the analyses of 1186 photo-quadrats, 186 different biota categories were recorded and catalogued. This included 41 types of algae, 65 types of sponges, 25 types of ascidians, 16 bryozoans, 17 cnidarians (including octocorals, anemones, and soft corals), as well as 5 bivalves, 3 annelids, 5 echinoderms, and crustacea (primarily barnacles). The cover of 15 different categories of substrate was also evaluated. As expected, macroalgae was moderately diverse, certain groups of sessile invertebrates were seemingly more diverse than normal for shallow temperate reef systems, and usually common groups such as echinoderms and molluscs were less diverse and abundant.

As identification of many sponges, ascidians etc. is highly doubtful without detailed examination of the animal in situ or in the lab, the number of different sessile invertebrates catalogued from photo-quadrats mostly related to the different physical forms observed in the imagery. Whilst most of the algae was categorised to species or genus level (35 of 41), 4 of the 25 ascidians, 10 of the 17 cnidarians, 4 of the 16 bryozoans, and only one of the 65 sponges were identified to species or genus. Rather than providing direct counts of species diversity, the categorisation of taxa will provide a detailed register of morphological forms for future identification, habitat descriptions, referencing and for locating possible undescribed species. Species catalogues and references images are available by contact of Neville Barrett at the Institute of Marine and Antarctic Studies (Neville.Barrett@utas.edu.au), and reference images are attached to printed copies of this report in a DVD inside the back cover. For the analysis of community composition, patterns were best described by lumping many of these invertebrates according to their morphological groups (see methods description). This data consisted of 76 groups of algae, invertebrates, substrate and biogenic substrate cover categories.

The composition of the benthic community displayed similar spatial patterns to those reported in 2002, with depth causing vertical zonation, and site position along Bathurst Channel causing horizontal zonation. This overall pattern can be observed in the MDS plots generated for 2010 data, which depict how transect sites are related to each other based on their benthic community composition (Figure 3.1). Sites with a high biotic similarity are positioned closely whilst sites that are different are depicted further apart. An overall stress value of 0.15 for the 2D MDS plot indicated a reasonable representation of the community patterns with some noise likely due to the complexity of physical and biological factors affecting the species present at each site. A clear separation of the different depths surveyed can be seen in the 2D plots, with this factor having a high correlation with MDS axis 1 (Pearson's correlation 0.63). The pattern of different sites along the channel west to east was more complex and was correlated with axis 1 and 2, 0.32 and -0.49 respectively.

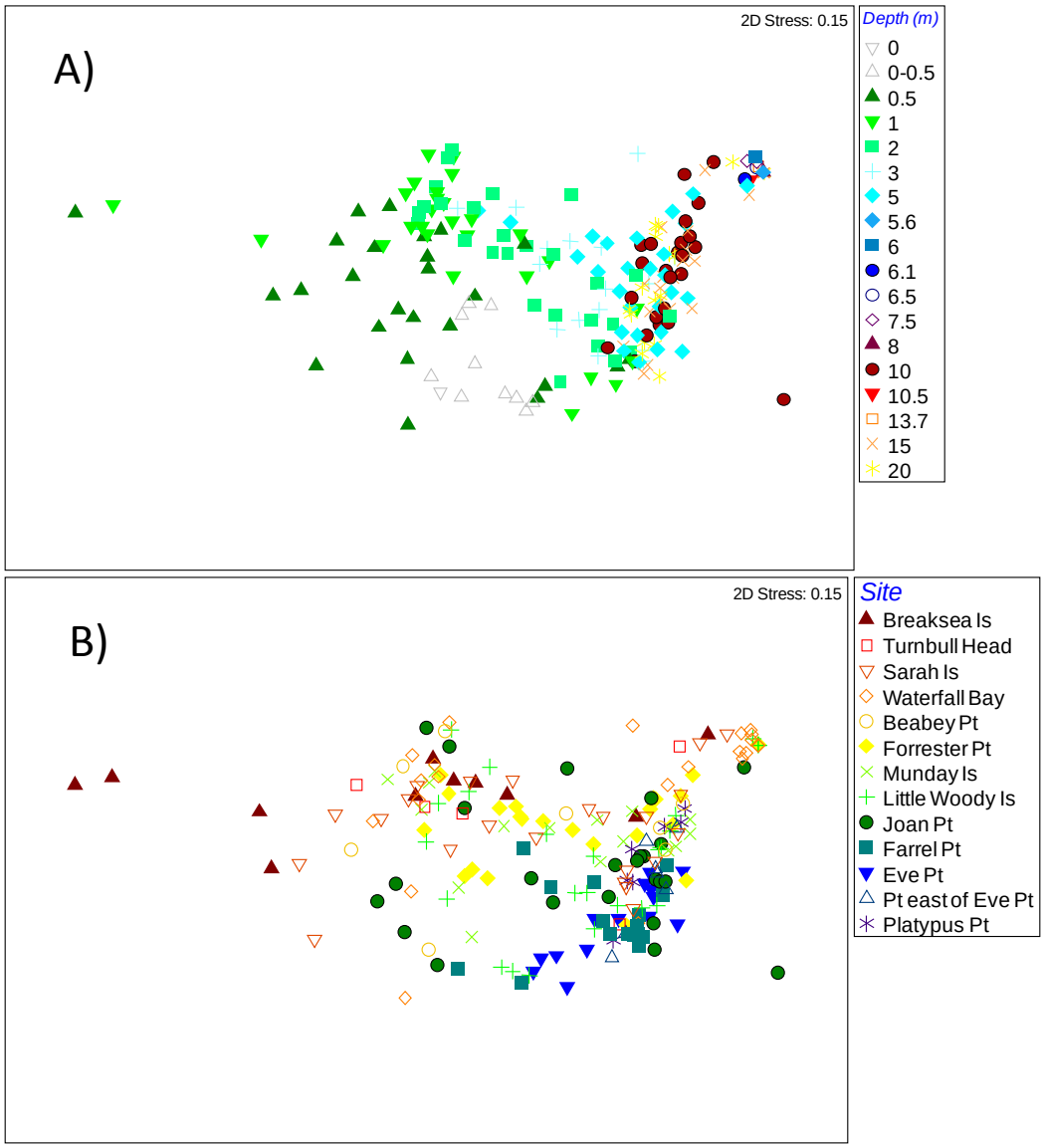

Figure 3.1 A two dimensional MDS ordination depicting the similarity of the benthic community composition at each unique depth/transect site. Symbols close to each other have a higher similarity in benthic community than symbols further apart. Symbols are coded according to depth in box A and site in box B.

3.2 Distribution of species throughout Bathurst Channel

The dominant influence of depth and site position along the channel on community composition can also be noted in the distribution and abundance patterns of the common algae and invertebrate species. Results for 2010 data for patterns in spatial distribution and abundance are discussed in section 3.2.1, 3.2.2 and 3.2.3, and matching graphs from the 2002 report are included in the appendices, as well as tables with percentage cover values and standard errors for each transect site.

3.2.1 Distribution and abundance of macroalgae in 2010

The composition and dominance of the macroalgal assemblage between transects varied throughout the channel. Sites subject to the greatest wave exposure were found in the western end of the estuary. These were generally subject to lower levels of surface water tannins, and higher salinity at shallow depths. These sites tended to have a higher coverage of brown and red algae in total (Figure 3.2a), and dominant macroalgal growth which extended to greater depths. At the three most western sites (Breaksea Island, Turnbull Head and Sarah Island) bull kelp (*Durvillea potatorum*) was the dominant species in the wave exposed shallows, reaching almost 100% cover in some cases (Figure 3.2a). At Breaksea Island, the western-most site where macroalgae was the dominant cover to the reef edge at 7-10 m, there was total cover of *D. potatorum* at 0.5 m with growth extending down to 2 m on transect 2. Bull kelp was the dominant cover in depths to 0.5 m at Turnbull Head and to 1m on the most exposed transect (T1) at Sarah Island. The hardy prostrate brown macroalgae *Carpoglossum confluens* was also present at depths of 2 m at Breaksea Island, Turnbull Head and Sarah Island (Figure3.2b), as well as the common kelp *Ecklonia radiata*, and a Tasmanian endemic kelp *Lessonia corrugata* (Figure 3.2a). *Phyllospora comosa* was present to 2m at Breaksea Island and Turnbull Head only (Figure 3.2a).

Red algae, possessing greater ability to survive in low light conditions, grew to deeper depths than the brown kelps. Sarah Island and Turnbull Head had the highest covers of *Thamnoclonium dichotomum* (Figure 3.2b), a red algae that is tolerant to lower light conditions due to its commensal association with an encrusting sponge which allows it to forego total reliance on photosynthesis. In deeper specimens of *T. dichotomum* within Bathurst Channel there is total coverage by the sponge component with no visible pigmentation indicative of red algae (Barrett *et al.*, 2002). These few specimens were classified as papillate sponges in the quadrat scoring. *Thamnoclonium dichotomum* and other red algae such as *Phacelocarpus pepperocarpos, Peysonnellia spp.,* and *Gelidium australe* were not uncommon at depths of 2 to 5 m at sites extending east to Munday Island. An underlying layer of encrusting coralline algae was present to 10m at Breaksea and 5 m at Sarah Island (Figure 3.2b).

At the moderately wind-fetch exposed sites of Waterfall Bay, Beabey Point, Forrester Point, Munday Island, Little Woody Island and Joan Point there was a different composition of brown macroalgae. A very high coverage of the common kelp *Ecklonia radiata* occurred at these sites, and was generally most abundant at 2 m in the western sites and 1m in the east (Figure3.2a). Above this, at a depth of 0.5 m *Carpoglossum confluens* was abundant, except at Waterfall Bay where it was found deeper and was replaced by *Xiphophora gladiata* and *Sargassum* spp. at 0.5 m (Figures3.2a, 3.2b). *Sargassum* was also moderately abundant at Little Woody Island at 0.5 m and Joan Point at 2 m. The highest abundances of the giant kelp *Macrocystis pyrifera,* which also grew at 0.5 m, were on more sheltered transect (T3) on Sarah Island (58% cover) and all 3 transects at Waterfall Bay (32%, 34% and 39% cover)

(Appendix Tables, Figure 3.2b). Between 0 and 0.5 m, *Hormosira banksii*, was a common feature at the moderately exposed sites from Beabey Point to Munday Island, but was more abundant further east from Little Woody Island to Eve Point where it reached 55-65% cover in the 0-0.5 m or 0.5 m depth bands.

Sheltered, eastern sites in the Bathurst Channel are subject to the lowest levels of light attenuation and lowest levels of salinity in shallow water, with episodic flooding events causing very low salinity at times. Overall levels of brown macroalgae were much lower at Farrell Point, Eve Point, the point east of Eve Point, and Platypus Point in the eastern channel area (Figure 3.2a). Instead, green algae were relatively more abundant at depths from 0.5-2 m at these sites and at Joan point. At other sites in the mid-section of Bathurst Channel, green algae grew only at 0-0.5 m, or deeper at Waterfall Bay and Beabey Pt. where some mat forming green algae were present. At Eve Point there was a particularly high abundance of Ulva (29%) and filamentous green algae (18%) at 1 m deep, algae which appear to be able to tolerate low salinity conditions.

3.2.2 Distribution and abundance of substrate and substrate cover in 2010

Beyond the zone of macroalgal growth, the cover recorded along transects generally consisted of identifiable sessile and mobile invertebrate species amongst a dominant biogenic-silt overgrowth on the reef substrate, and a bare sand, silt, gravel, or cobble substrate at or beyond the reef edge. There were several types of biogenic cover observed and categorised during the photo analysis. The most common were; "algal turf" (a turfing mat growing over rock which is primarily consisting of filaments of algae 5mm or less long), "algal/hydroid/silt matrix" (a matrix of turfing algae, small hydroids and silt over rock), "bryozoan/hydroid matrix" (a turfing mixture of small bryozoans, hydroids and sediment on bare rock), and "biogenic matrix" (a mixture of small invertebrates and microscopic algae more complex in nature than the previously described turfing substrate covers). One or more of these types of cover was present at every site, but in general there was more total substrate cover by these overgrowth categories at the more sheltered eastern end of the system (Figure 3.2c).

High covers of "algal turf" were found at shallow depths in the mid-section of the channel (Figure 3.2c). The "bryozoan/hydroid matrix" cover was common throughout the channel except for at Breaksea Island, where it was not present, and at Turnbull head and Waterfall Bay, where it was only present at one transect and depth. Most cover occurred from depths of 5m and deeper in the western sites where foliose algae dominated shallower depths, and in the mid channel, where sessile invertebrate cover was dominant in shallower depths. The "algal/hydroid/silt matrix" cover showed the strongest patterning over the channel system. It was present in high abundance at relatively shallow depths in the sheltered end of the channel, being moderately abundant in the mid-section of the channel and in relatively low abundance at the more exposed sites (Figure 3.2c). Overall, the proportion of bare substrate and substrate with some form of biogenic-silt cover was highest at all depths at the most eastern sites where there was a paucity of both both macroalgal and large sessile invertebrate cover.

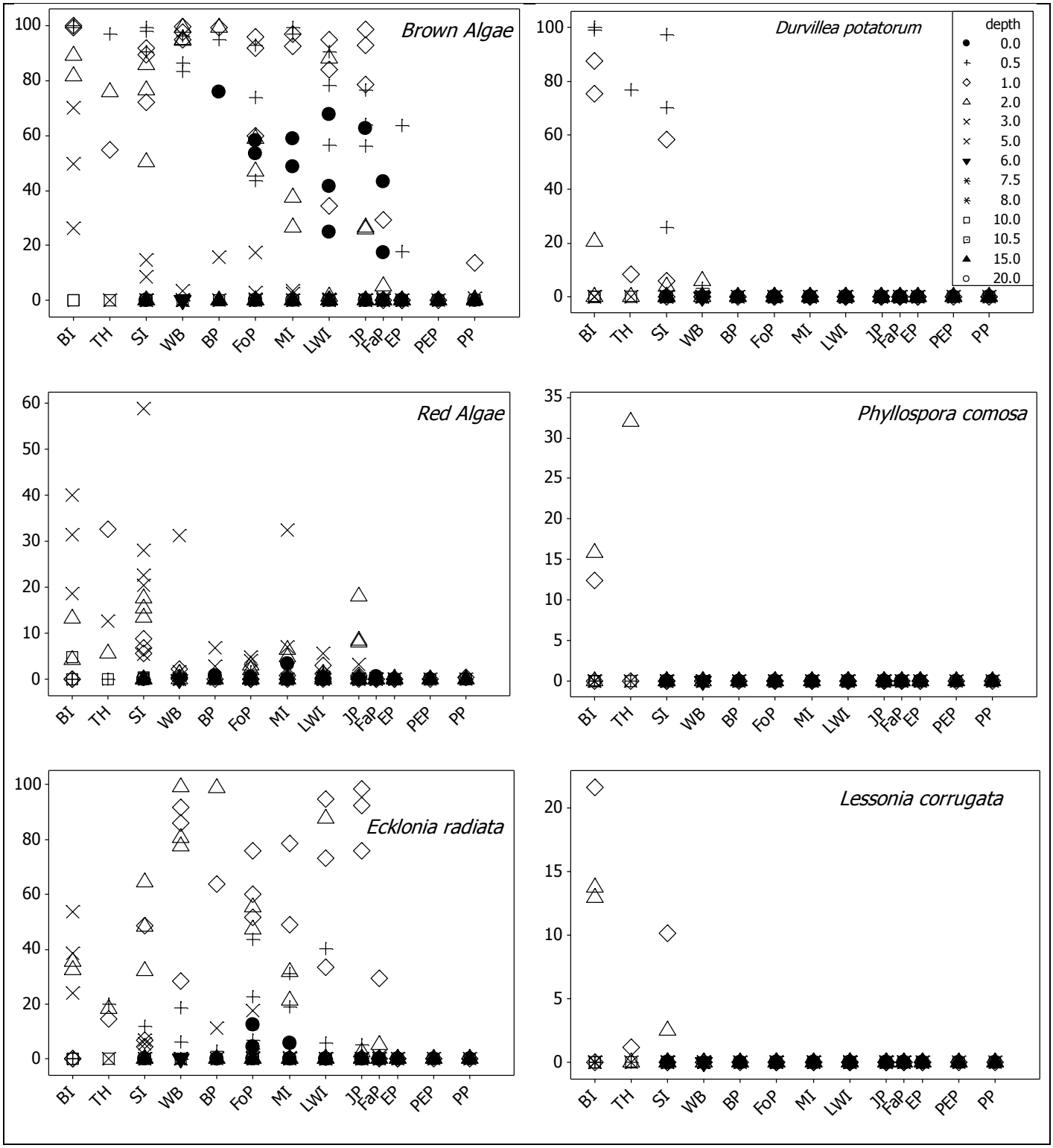

Figure 3.2a. Mean percentage cover of algal species/groups for each transect and depth combination at each survey site. Some sites have multiple transects and not all depths were sampled at each site. BI=Breaksea Island, TH= Turnbull Head, SI=Sarah Island, WB = Waterfall Bay, BP = Beabey Point, FoP = Forrester Point, MI = Munday Island, LWI= Little Woody Island, JP= Joan Point, FaP = Farrell Point, EP = Eve Point, PEP = Point east of Eve Point, PP = Platypus Point.

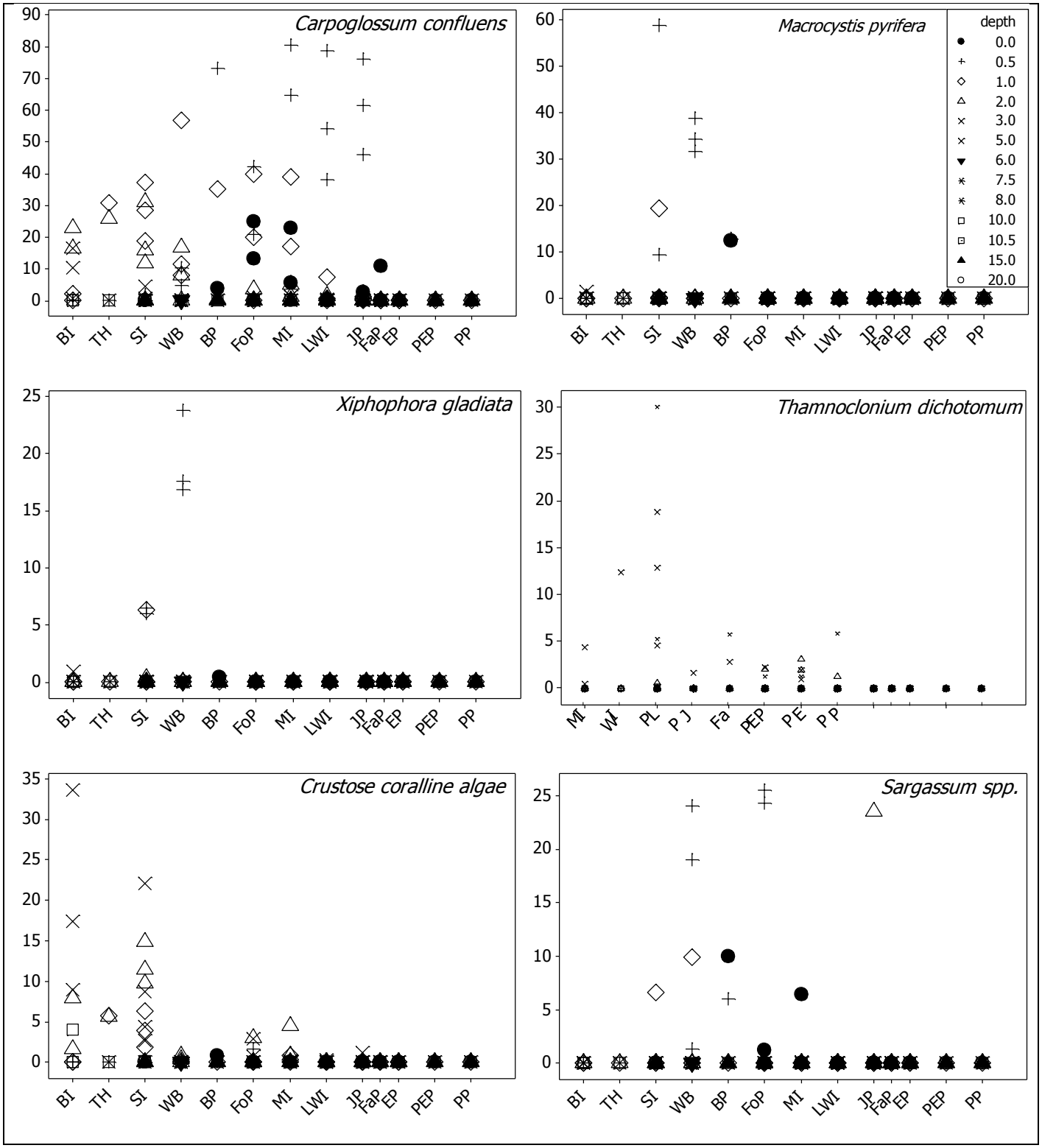

Figure 3.2b. Mean percentage cover of algal species/groups for each transect and depth combination at each survey site. Some sites have multiple transects and not all depths were sampled at each site. BI=Breaksea Island, TH= Turnbull Head, SI=Sarah Island, WB = Waterfall Bay, BP = Beabey Point, FoP = Forrester Point, MI = Munday Island, LWI= Little Woody Island, JP= Joan Point, FaP = Farrell Point, EP = Eve Point, PEP = Point east of Eve Point, PP = Platypus Point.

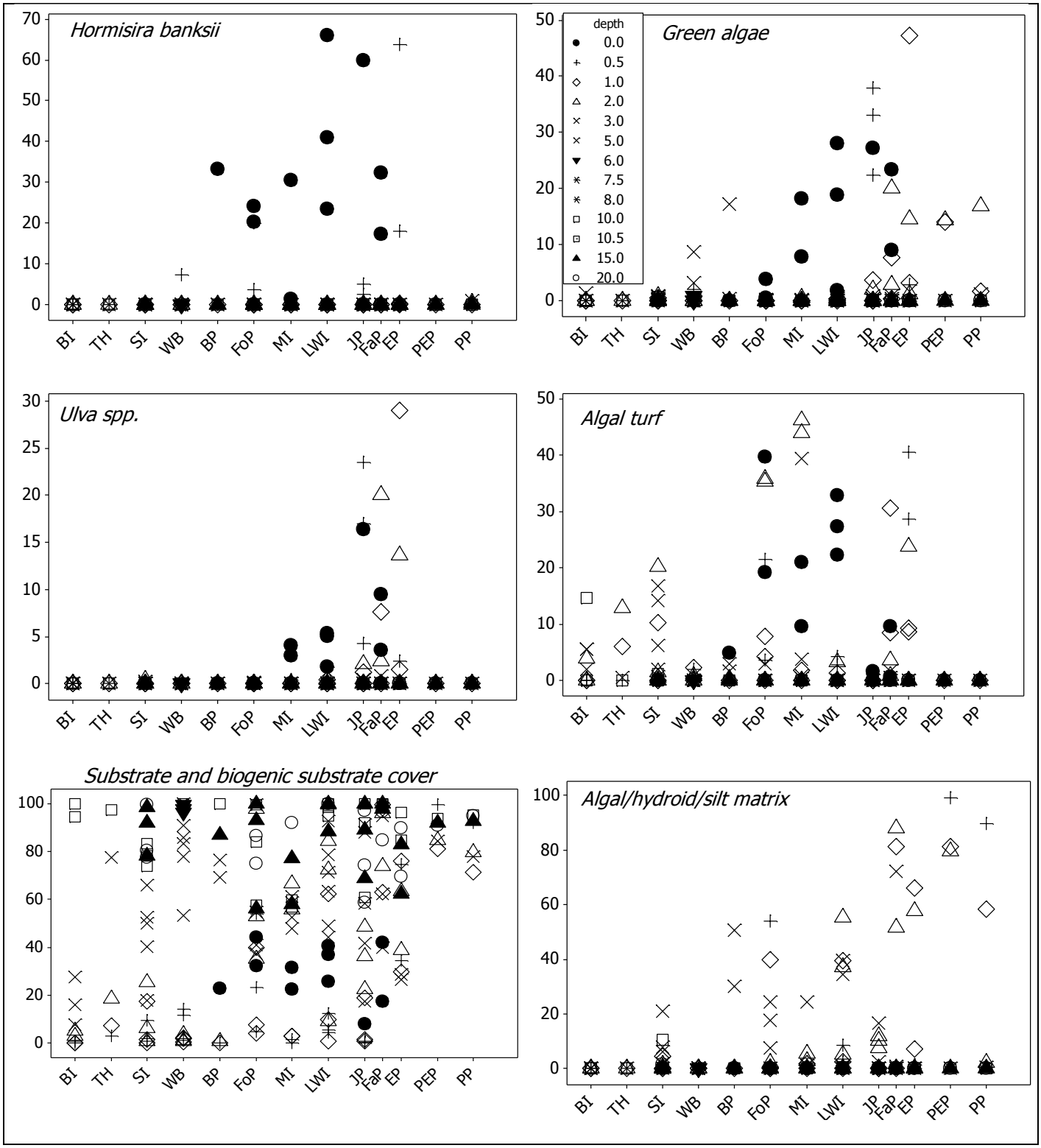

Figure 3.2c. Mean percentage cover of algal species, and substrate cover for each transect and depth combination at each survey site. Some sites have multiple transects and not all depths were sampled at each site. BI=Breaksea Island, TH= Turnbull Head, SI=Sarah Island, WB = Waterfall Bay, BP = Beabey Point, FoP = Forrester Point, MI = Munday Island, LWI= Little Woody Island, JP= Joan Point, FaP = Farrell Point, EP = Eve Point, PEP = Point east of Eve Point, PP = Platypus Point.

3.2.3 Distribution and abundance of invertebrate cover in 2010

The assemblages of invertebrate cover surveyed throughout Bathurst Channel varied in composition and abundance between sites, with some sites displaying special importance for certain key/iconic species. In general, total invertebrate cover was in highest abundance at sites and depths where large brown macroalgae are not as dominant on the reef; except for in the 2 most eastern sites, Platypus Point and at the point east of Eve Point, where there was overall low algal and invertebrate cover (Figure 3.3a). At Breaksea Island in the west, for example, there were almost no invertebrates and there was a dominance of red and brown macroalgae down to the reefs edge between 5 and 10 m (Figure 3.2 and 3.3). Similarly few invertebrates were present at Turnbull Head. At Platypus Point and the point east of Eve Point, the cover was dominated by substrate cover (algal/hydroid matrix and bryozoan/hydroid matrix), which graded to sand/silt at 10 m at Platypus Point.

At most sites, the highest percentages of invertebrate cover were generally found around depths of 3-5 m, where algae were restricted in growth and adequate current flow persisted. The dominating invertebrates in this depth band were most often species of soft coral (either *Drifa* spp. or *Clavularia* spp.), with high cover occurring at sites in the mid channel; Forrester Point, Joan Point, Farrell Point, Little Woody Island, Munday Island and Eve Point, as well as at Sarah Island (Fig 3.3a). Notably, high abundances of *Clavularia* were in the mid-section of Bathurst Channel at Forrester Point and Munday Island at a range of depths between 5 and 15 m, whereas specimens of *Drifa* were most abundant in the mid to eastern section of the channel at Little Woody Island, Joan Point, Farrell Point and Eve Point at depths of 3 to 5 m, peaking in abundance at 76% cover on Joan Point T2. The cover of hard bryozoans (lace, plate and branching forms) also peaked at around 5m deep, as did sea whips (*?Primnoella australasiae*). At depths below 5 m *Clavularia* was common however other invertebrates were variable between sites, with sea pens, bramble corals, soft bryozoans, zooanthids, cup sponges, and solitary corals being feature components of the assemblage at certain sites. Sponges and ascidians were commonly present but variable in percentage cover throughout the sites and depth ranges.

Sarah Island was an important area for invertebrate diversity in general. It was a key site for the gorgonian *Pteronisis plumacea* (found at 5m depth), the bramble corals *Asperaxis kareni* and *Acabaria* spp. at a range of depths, and has a moderate cover of mixed sponge forms at 10-20 m deep (figure 3.3a, see appendix tables also). It was also the only site with soft bryozoans, which occurred at 5 -20 m deep, and a colonial ascidian which was relatively abundant (13%) at 10m on transect 2. Sea pens, *Sarcoptilus grandis*, were an iconic feature found at the next site further east, Waterfall Bay, in depths of 6 - 7.5 m amongst a sandy substrate bottom (Figure 3.3b), with a few specimens also sighted at Sarah Island at 10 m. Further east at Forrester Point and Munday Island, sea whips, normally a deeper water species, were found in 5 m of water at percentages between 3 and 12 % of the total benthic cover (Fig 3.3b). Forrester Point, along with Sarah Island and Joan Point, was also a key site for cup sponges, found at 15-20m deep, along with yellow zooanthids which also peaked in abundance at 15-20 m deep (Fig3.3b).In the mid-section of Bathurst channel, lace bryozoans including a similar form of hard bryozoan without perforations were found in unusually high abundances at Little Woody Island on transect 1, reaching 13% overall coverage at 5 m deep (Figure 3.3b).

In the eastern region Bathurst Channel constricts significantly into a section known as ‘The Narrows’, which includes the sites at Joan Point and Farrell Point which form the western entrance to the narrow channel, Eve Point, the point east of Eve Point and Platypus Point, the

eastern most site. At the 3 most eastern sites in the Narrows, the dominance of macroalgae in the shallow depths was replaced with a greater abundance of turfing substrate cover, and more 'opportunistic' fast growing species resilient to low salinity such as polychaetes (mainly tube worms), bivalves/mussels, the red-throated solitary ascidian *Herdmania grandis*, and barnacles. Cover of these seemed variable between sites, but Eve Point had particularly high abundances of these filter feeding invertebrates at a depth of 2m (Fig 3.3c). Greater depths were again characterised by a high abundance of turfing substrate cover (mainly a bryozoan/hydroid matrix), a low total invertebrate cover at the two most eastern sites, and the growth of solitary corals at depths of 10-20 m.

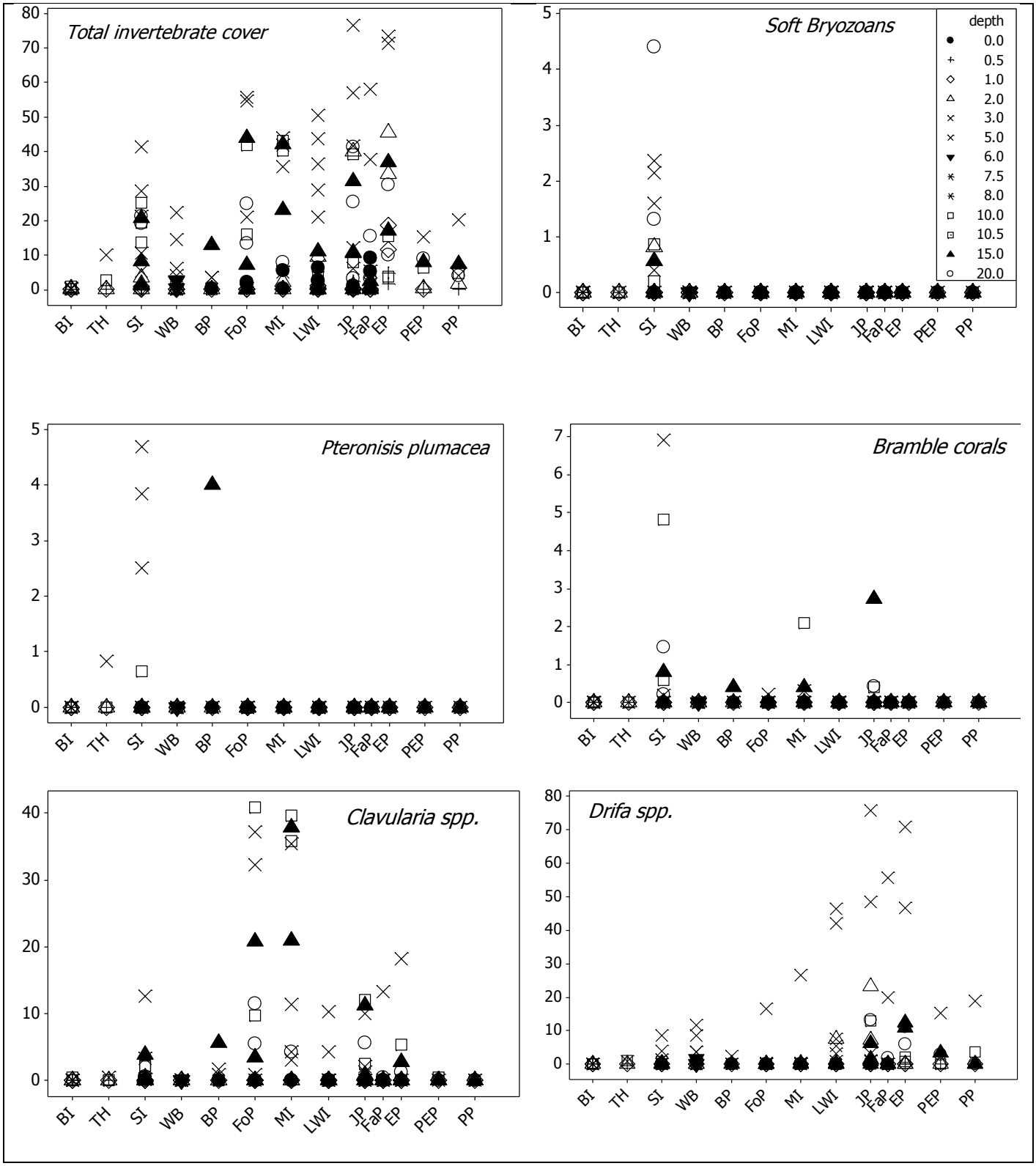

Figure3.3a. Mean percentage cover of invertebrate species/groups for each transect and depth combination at each survey site. Some sites have multiple transects and not all depths were sampled at each site. BI=Breaksea Island, TH= Turnbull Head, SI=Sarah Island, WB = Waterfall Bay, BP = Beabey Point, FoP = Forrester Point, MI = Munday Island, LWI= Little Woody Island, JP= Joan Point, FaP = Farrell Point, EP = Eve Point, PEP = Point east of Eve Point, PP = Platypus Point.

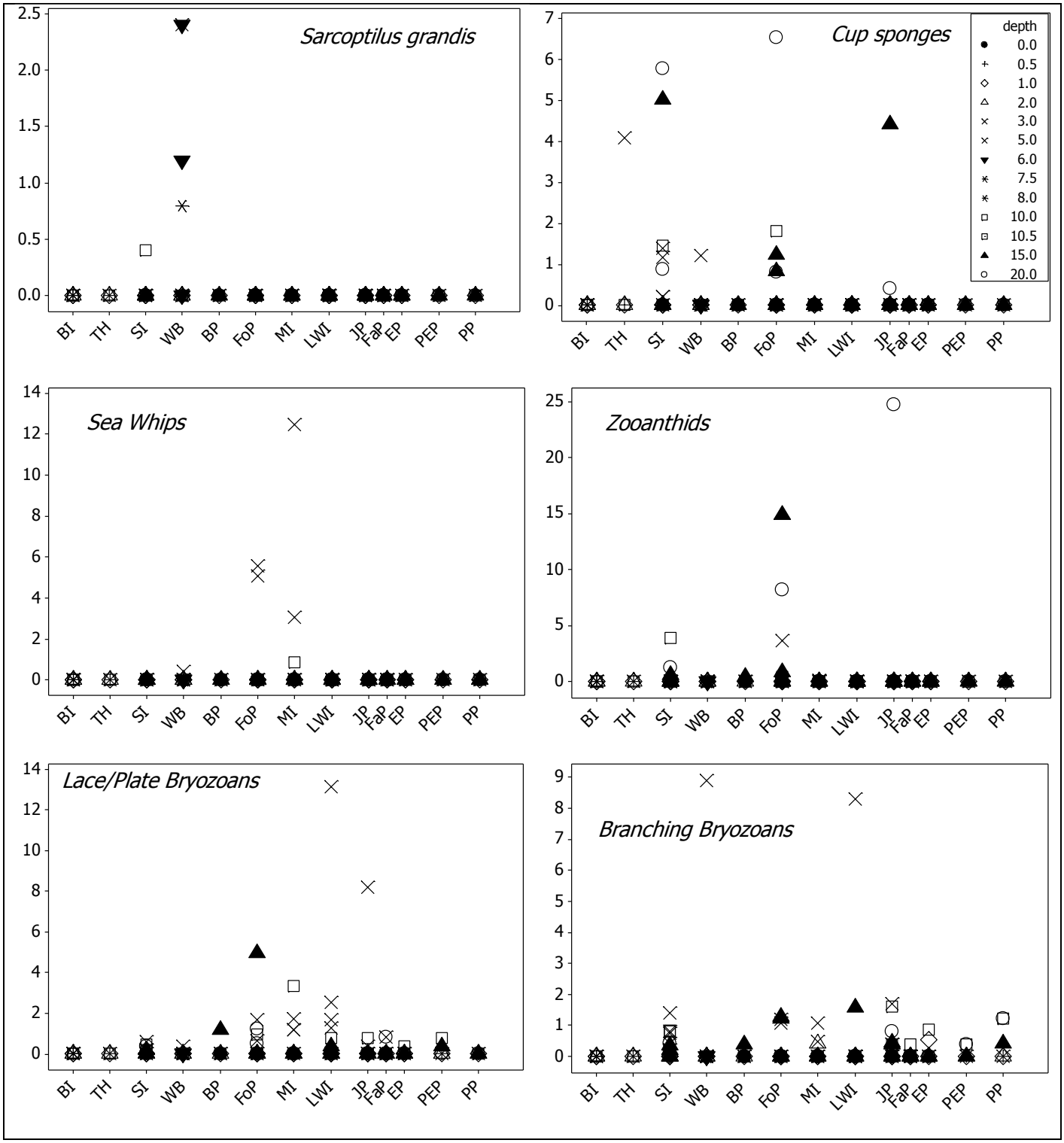

Figure 3.3b. Mean percentage cover of invertebrate species/groups for each transect and depth combination at each survey site. Some sites have multiple transects and not all depths were sampled at each site. BI=Breaksea Island, TH= Turnbull Head, SI=Sarah Island, WB = Waterfall Bay, BP = Beabey Point, FoP = Forrester Point, MI = Munday Island, LWI= Little Woody Island, JP= Joan Point, FaP = Farrell Point, EP = Eve Point, PEP = Point east of Eve Point, PP = Platypus Point.

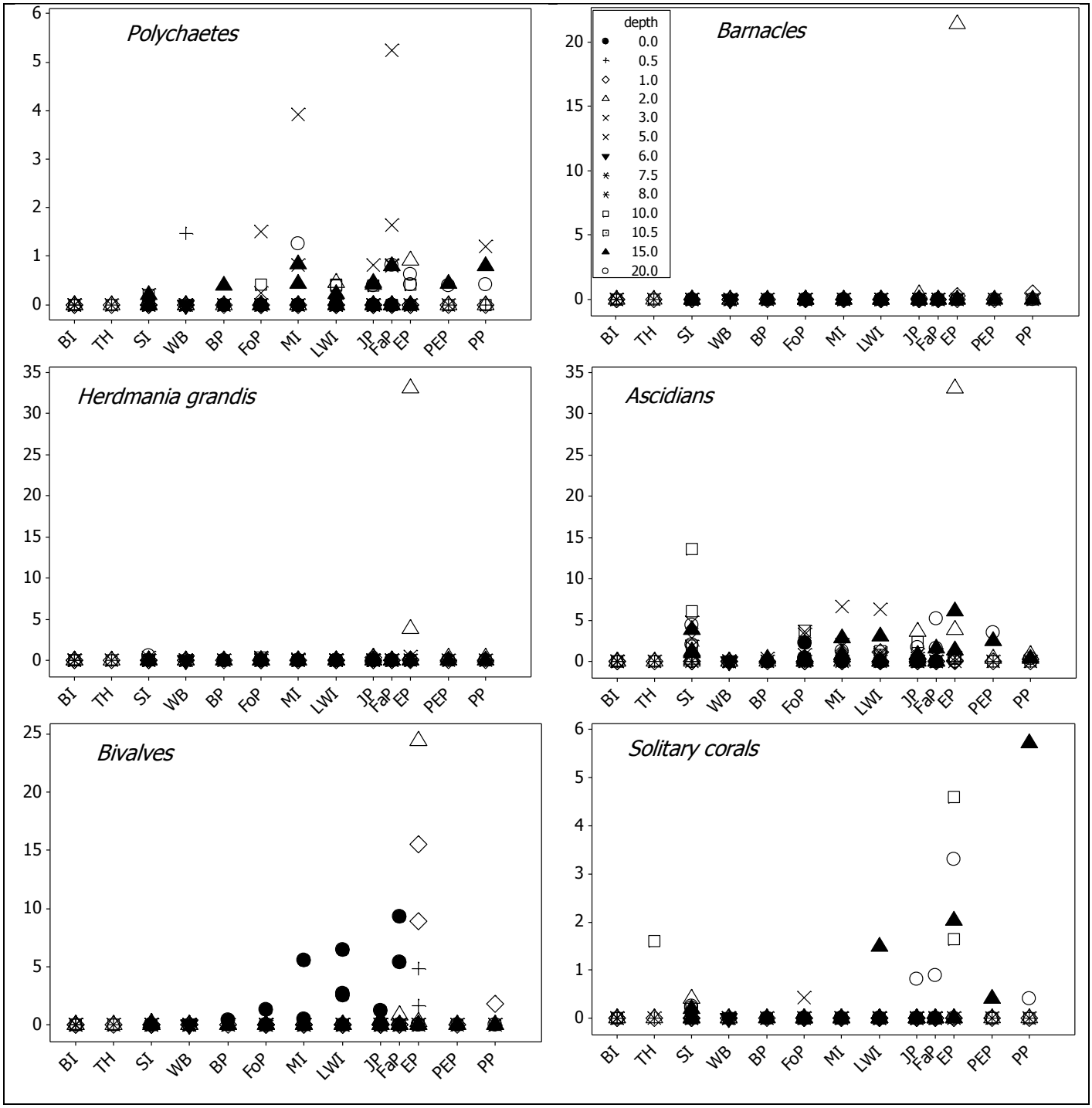

Figure 3.3c. Mean percentage cover of invertebrate species/groups for each transect and depth combination at each survey site. Some sites have multiple transects and not all depths were sampled at each site. BI=Breaksea Island, TH= Turnbull Head, SI=Sarah Island, WB = Waterfall Bay, BP = Beabey Point, FoP = Forrester Point, MI = Munday Island, LWI= Little Woody Island, JP= Joan Point, FaP = Farrell Point, EP = Eve Point, PEP = Point east of Eve Point, PP = Platypus Point.

3.3 Abundance trends for characteristic invertebrate species and community types throughout Bathurst Channel

The report analysis from the 2002 survey separated Bathurst Channel into 4 'zones' based on the summarised trends in composition and cover of the benthic organisms (Barrett *et al.*, 2002). Within each zone are key study sites for benthic species which characterise or are anomalous/iconic to the area, and are thus important indicators to monitor more closely for change in the fragile Bathurst Channel ecosystem. The first zone, a 'marine' zone extended from Breaksea Island to Beabey Point, followed by a 'sea whip' zone extending further east to Munday Island. Little Woody Island east to Eve Point were included in the 'soft coral and bryozoan' zone, whereas sites further east were included in the 'barren' zone, which has a low cover invertebrates and macroalgae. Sections 3.3.1 – 3.3.4 discuss the characteristics of each zone and the abundance estimates of indicator species in 2010 and 2002 within each zone. Notably, the patchy distribution of many of these iconic species has resulted in high standard error values for the percentage cover estimates within each depth range. This coupled with a low percentage cover for most of these individual species resulted in low statistical power to detect subtle changes in abundance between 2002 and 2010 data.

3.3.1 The marine zone

In the most western section of the channel, the marine zone was characterised by a high diversity of benthic organisms, and a moderate restriction of the photic zone to between 5-10 m depth (Barrett *et al.*, 2002). In both 2002 and 2010, the average percentage cover of macroalgae at each site in the marine zone tended to be higher than other zones and this was especially apparent in the depth intervals of 2-4.9 m and 5-7.9 m (Fig. 3.4b and 3.4c). The exception to this was the site at Waterfall Bay which had low average cover of macroalgae and lower diversity of biota because of the high proportion of sandy substrate present (site was primarily included for monitoring of sea pen abundance). Estimated total percentage cover of algae at each site was higher in 2010 than 2002 at Sarah Island and Waterfall Bay. Signature species which were restricted to, or had high abundances within the marine zone included sea pens, two species of stoloniferous octocorals (bramble corals), the branching gorgonian (*Pteronisis plumacea*), cup sponges at Sarah Island and Turnbull Head, as well as the sponge-associated red algae *Thamnoclonium dichotomum* (Fig. 3.5). Variation between 2002 and 2010 results for percentage cover of these species differed between sites and was likely to be caused by a mix of insufficient replicate images scored (as all species had a low overall cover and were generally patchily distributed) and changes associated with a prolonged drought in the years leading up to the 2010 survey. The gorgonian *Pteronisis plumacea* was newly observed at Beabey Point and Turnbull Head in 2010, but was very varied in abundance, and was not recorded outside of the marine zone in either 2002 or 2010 (Fig. 3.5d).

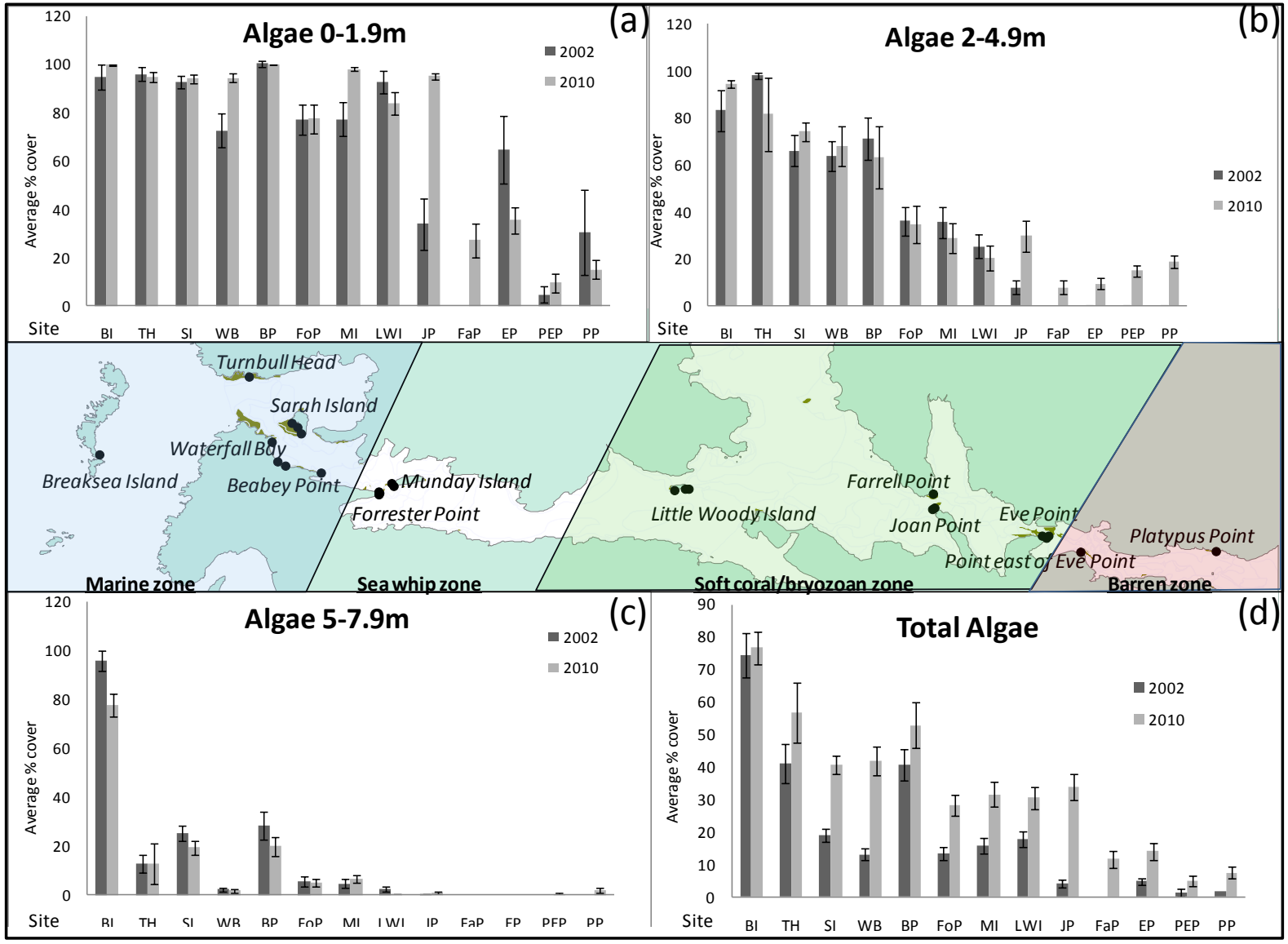

Fig. 3.4. The average percentage cover of all macroalgae in 2002 and 2010 at each site surveyed in Bathurst Channel in a) 0-1.9m deep, b) 2-4.9m deep, c) 5-7.9m and d) in total. Site codes are as follows: BI= Breaksea Island, TH= Turnbull Head, SI= Sarah Island, WB= Waterfall Bay, BP= Beabey Point, FoP= Forrester Point, MI= Munday Island, LWI= Little Woody Island, JP= Joan Point, FaP= Farrell Point **, EP=Eve Point.

** *Farrell Point was not surveyed in 2002.*

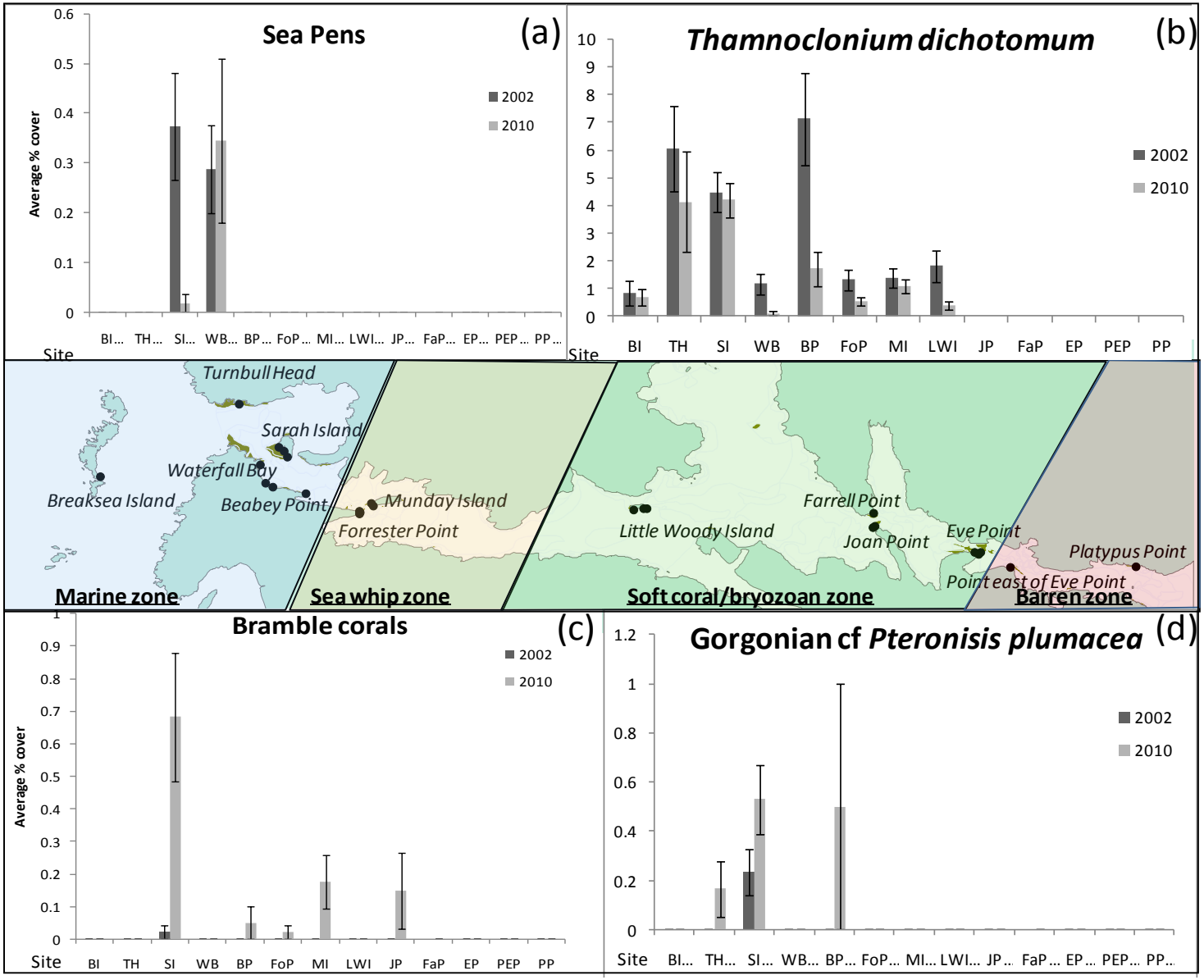

Fig. 3.5. The average percentage cover in 2002 and 2010 at each site surveyed in Bathurst Channel of: a) Sea Pens, b) the red algae *T. dichotomum*, c) Bramble corals and d) *P. plumacea*. Site codes are as follows: BI= Breaksea Island, TH= Turnbull Head, SI= Sarah Island, WB= Waterfall Bay, BP= Beabey Point, FoP= Forrester Point, MI= Munday Island, LWI= Little Woody Island, JP= Joan Point, FaP= Farrell Point **, EP=Eve Point.

** *Farrell Point was not surveyed in 2002.*

Sea Pens, *Sarcoptilus grandis*, were only present at two sites within Bathurst Channel, Waterfall bay and Sarah Island (Fig. 3.5a), where aggregations were present in sheltered spots with a sandy substrate. The average cover of sea pens was low, and was quite variable in both years due to their patchy distribution and the fact that the detection of individuals within a photo image is dependent on whether they were extended or withdrawn into the substrate (behaviour related to feeding patterns associated with tidal cycles). At Waterfall Bay, the highest cover of sea pens was found between 5 and 7.9 m deep in both years (Fig. 3.6). In 2002 sea pens were also recorded within the 8-10.9 m and 11-15.9 m depths bands however none were recorded in the 8-10.9 m depth band in 2002 and the deeper depths were not surveyed in 2010. At Sarah Island sea pens were recorded on the more sheltered transect 3, in the 8-10 m depth band where sandy substrate occurred (Fig. 3.7). They were present in both years, although the recorded cover was higher in 2002.

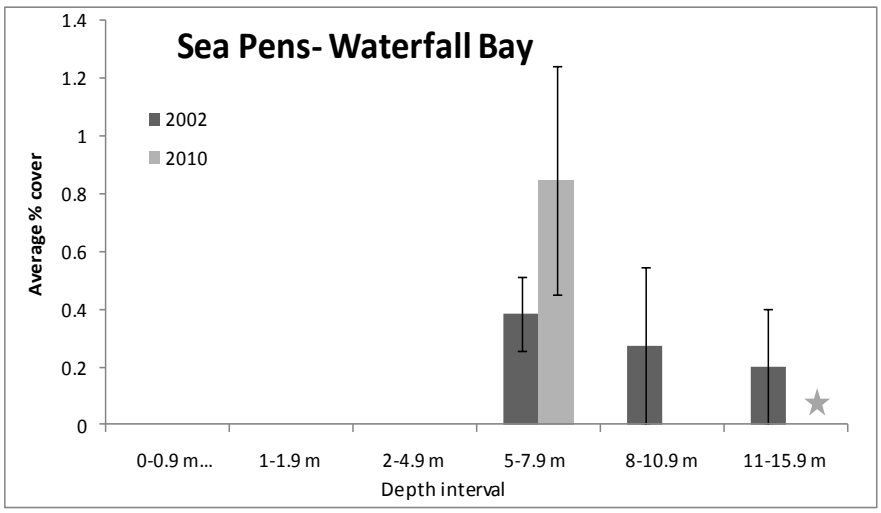

Fig. 3.6. The average cover of sea pens in 2002 and 2010 within each depth band over the 3 transects sampled at Waterfall Bay. ★ The 11-15.9m depth band was not surveyed in 2010.

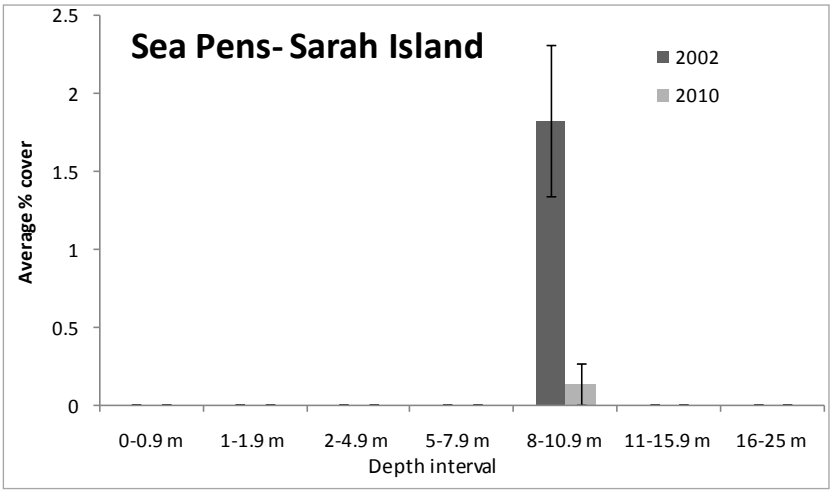

Fig. 3.7. The average cover of sea pens in 2002 and 2010 within each depth band over the 3 transects sampled at Sarah Island.

Bramble corals were also low in abundance overall but occurred in most abundance at Sarah Island in both 2002 and 2010 (Fig 3.5c). Higher abundances were recorded over more depth ranges in 2010, although percentage cover within each depth range did not exceed 2.5%. These corals tended to be patchy in distribution and had a high variation in percentage cover (Figure 3.8).

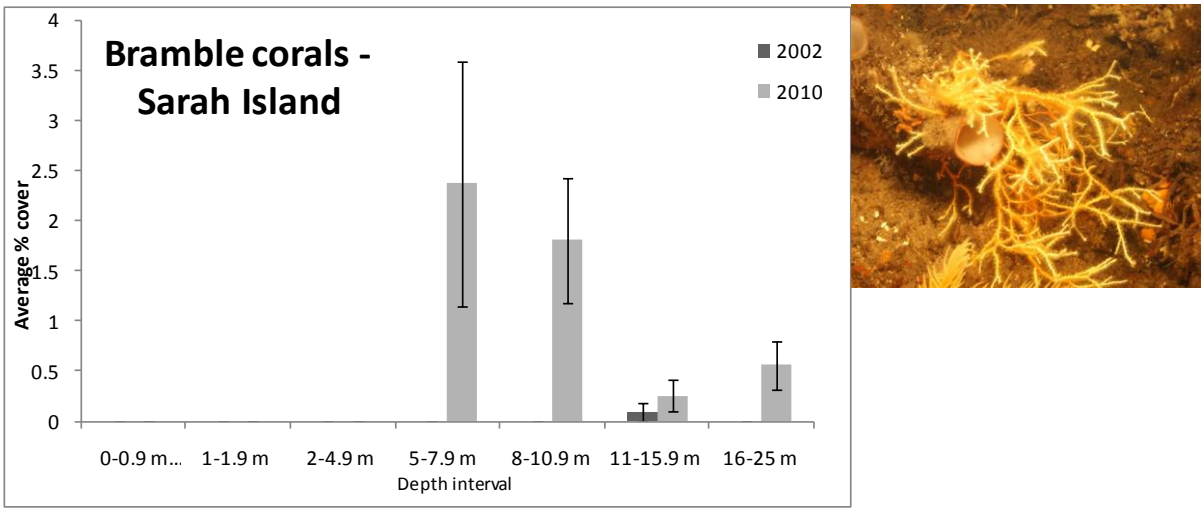

Fig. 3.8. The average cover of bramble corals in 2002 and 2010 within each depth band over the 3 transects sampled at Sarah Island.

The site with the highest abundance of cup sponges, Sarah Island, had a consistent cover between the two survey years (Fig. 3.9), with higher covers predominantly occurring on transect 3, in depths beyond 5m where the substrate was reef covered with a matrix of fine sediment, small hydroids and bryozoans. The dominant species observed was *Strepsichordata caliciformis,* a relatively common temperate Australian deep-water sponge species found typically in areas of high current flow. At Turnbull Head, the distribution of cup sponges was similar, although none were recorded in the 8-10.9 m depth band in 2010 as the samples taken (at 10 m deep) were on bare sand (Fig 3.10).

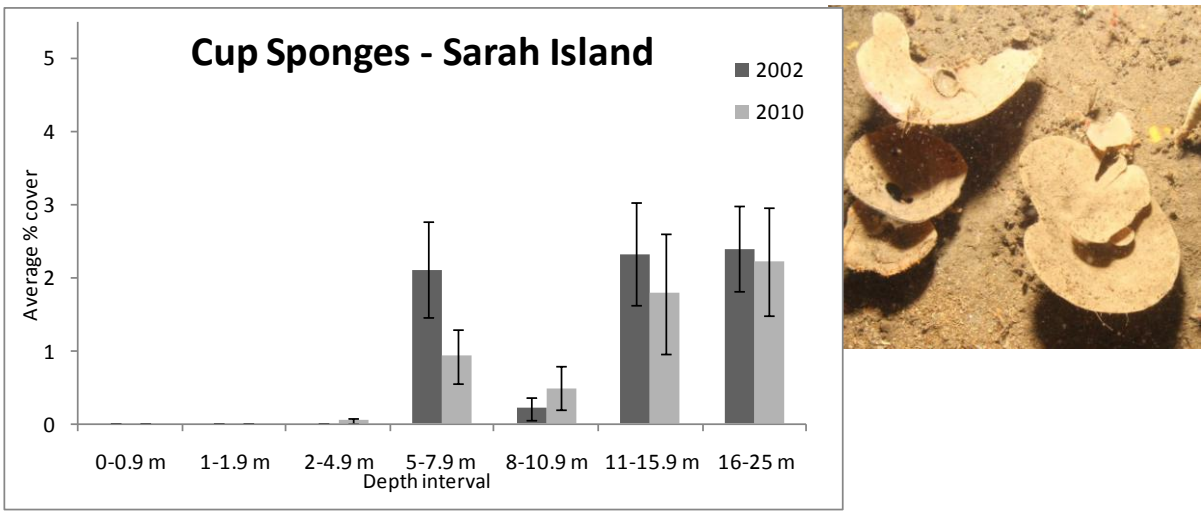

Fig. 3.9. The average cover of cup sponges in 2002 and 2010 within each depth band over the 3 transects sampled at Sarah Island.

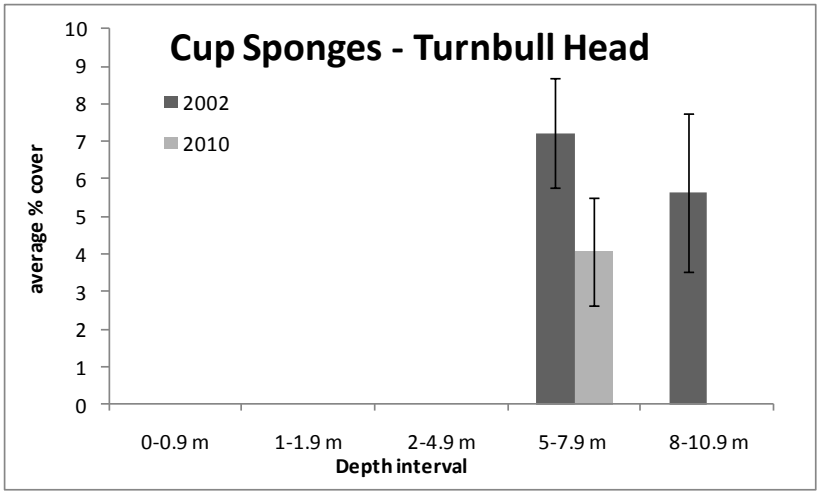

Fig. 3.10. The average cover of cup sponges in 2002 and 2010 within each depth band at Turnbull Head (one transect sampled).

The gorgonian *Pteronisis plumacea* was newly observed at Beabey Point and Turnbull Head in 2010, but was very varied in abundance, and was not recorded outside of the marine zone in either 2002 or 2010 (Fig. 3.5d). At Sarah Island, the recorded percentage cover was greatest in 2010 in the 5-7.9m depth interval, but did not exceed 3.5% (Fig 3.11). It was detected at deeper depths in 2002 than 2010.

The cover of *Thamnoclonium dichotomum* was greatest in the marine zone, and at moderate depths where large brown macroalgae decreased in abundance. In the marine zone this was at 5-7.9 m (Fig. 3.12) where light limitation meant that red algae were comparatively more dominant than green or brown. This followed a similar pattern in 2002 to 2010.

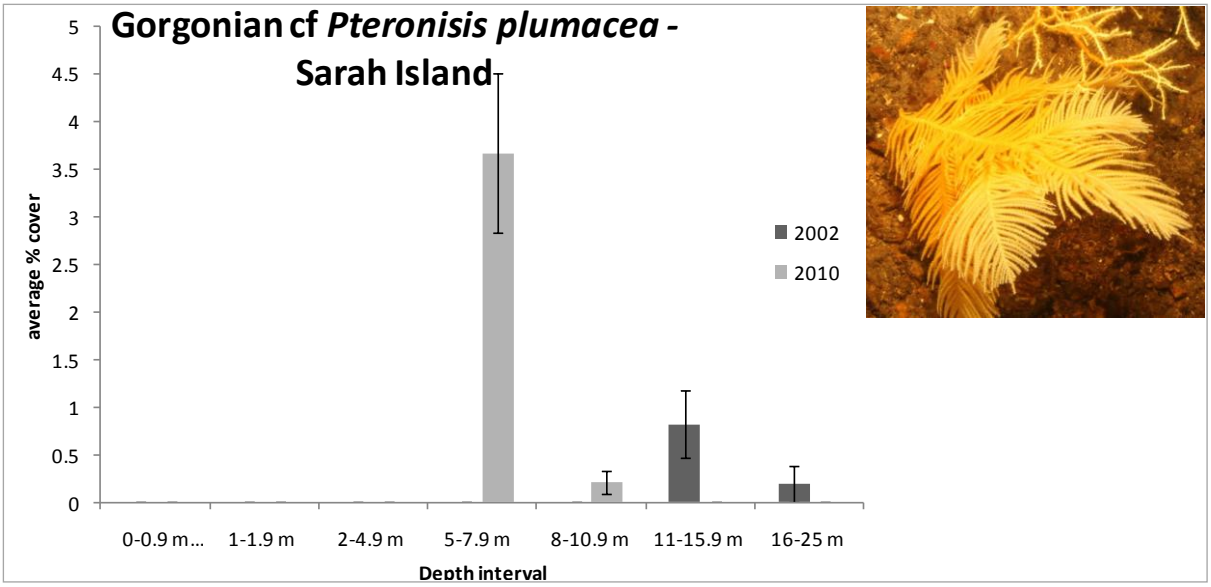

Fig. 3.11. The average cover of the branched gorgonian *Pteronisis plumacea* in 2002 and 2010 within each depth band along the 3 transects sampled at Sarah Island

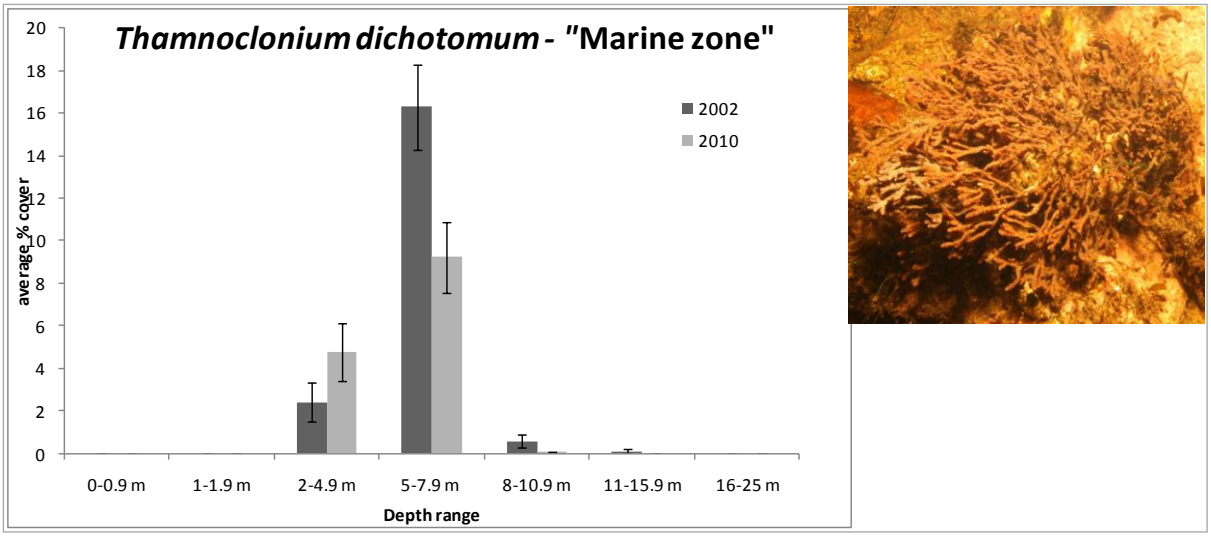

Fig. 3.12. The average cover of the sponge associated red macroalgae *Thamnoclonium dichotomum* in 2002 and 2010 within each depth band over the sites included in the 'marine zone'*; Breaksea Island, Turnbull Head, Sarah Island, and Beabey Point. Waterfall Bay was excluded due to its low overall macroalgal cover and high proportion of bare sand surveyed for sea pens.

3.3.2 The sea whip zone

The second 'zone' in the Bathurst Channel marine system included sites at Forrester Point and Munday Island, and was the area where sea whips were found in highest abundance (Fig. 3.13b). Here there was a stronger effect of tannins in the water, further restricting the depth penetration of algae, as only a low cover persisted at 5 m in both 2002 and 2010 (Fig 3.4). This was also associated with the loss of some algal species adapted to higher wave exposure such as *Durvillea potatorum*, *Lessonia corrugata*, *Macrocystis pyrifera* and *Xiphophora gladiata*. Aggregations of sea whips were found at depths of 5 m where macroalgae is no longer dominant due to the increased restriction of light penetration in the water column. Beyond 5 m deep there was a loss of some species associated with the marine zone, such as sea pens, soft bryozoans and the gorgonian *Pteronisis plumacea*, however, sea whips, zooanthids, cup sponges and the colonial gorgonian of the genus *Clavularia* spp. were present at these depths (Figs. 3.5, 3.3a and 3.13).

Sea whips, presumably *Primnoella australasiae* (and/or a closely related species) occurred in patches of high density at Munday Island and Forrester Point and were not found further east in the Bathurst Channel. The average cover of sea whips peaked at 5 m at both these sites, and in 2002 the average cover was more than 10% of the reef within the 5-7.9 m depth band (Fig. 3.14 and 3.15), occurring on patches of reef with *Clavularia* spp. and a turfing matrix with sediment, algae or bryozoans (Appendix Tables 20-29). At Forrester point sea whips occurred on transects 1 and 2, whilst transect 3 was around 80% bare sand by 5 m depth. At Munday Island sea whips occurred densely on transect 1 (up to 28% cover in 2002 at 5m) and sparsely on the 2nd transect in both years (Appendix Tables 26-29). Whilst sea whips are readily apparent in photographs from both years, being upright, fairly evenly distributed in an area, and of a contrasting colour to the substrate, there was an apparent decline in the cover of sea whips over time. The percentage cover of sea whips recorded at the 5-7.9m depth band reduced from around 12% to around 4% between 2002 and 2012 at Forrester Point and from around 16% to around 10% at Munday Island during the same period (Figs. 3.14 and 3.15).
These declines were amongst the most notable changes detected during the survey comparison, amounting to an average decline of around 50% in the 5-8m depth category.

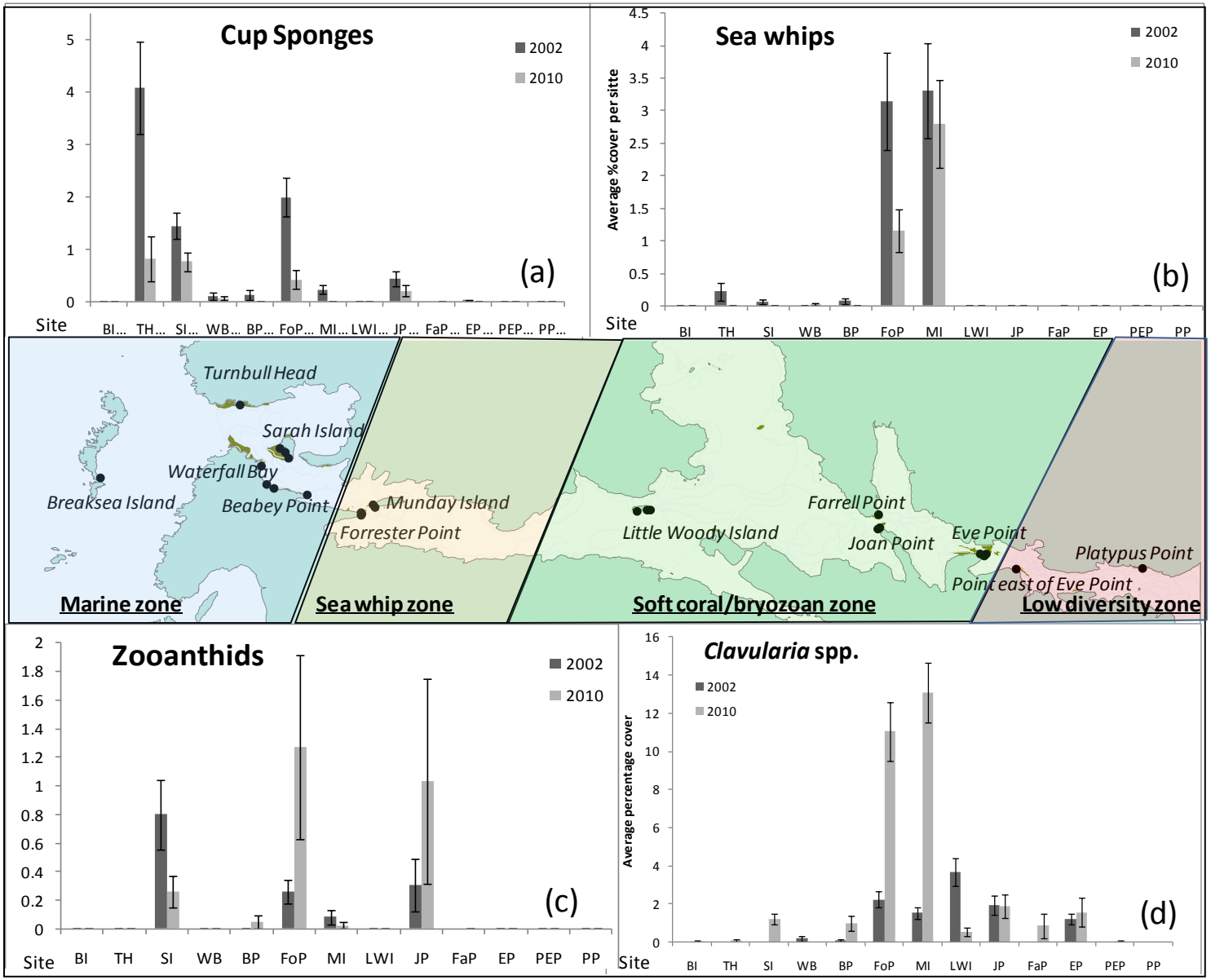

Fig 3.13. The average percentage cover in 2002 and 2010 at each site surveyed in Bathurst Channel of: a) cup sponges, b) sea whips, c) zooanthids and d) the soft coral *Clavularia* spp. Site codes are as follows: BI= Breaksea Island, TH= Turnbull Head, SI= Sarah Island, WB= Waterfall Bay, BP= Beabey Point, FoP= Forrester Point, MI= Munday Island, LWI= Little Woody Island, JP= Joan Point, FaP= Farrell Point **, EP=Eve Point.
*** Farrell Point was not surveyed in 2002.*

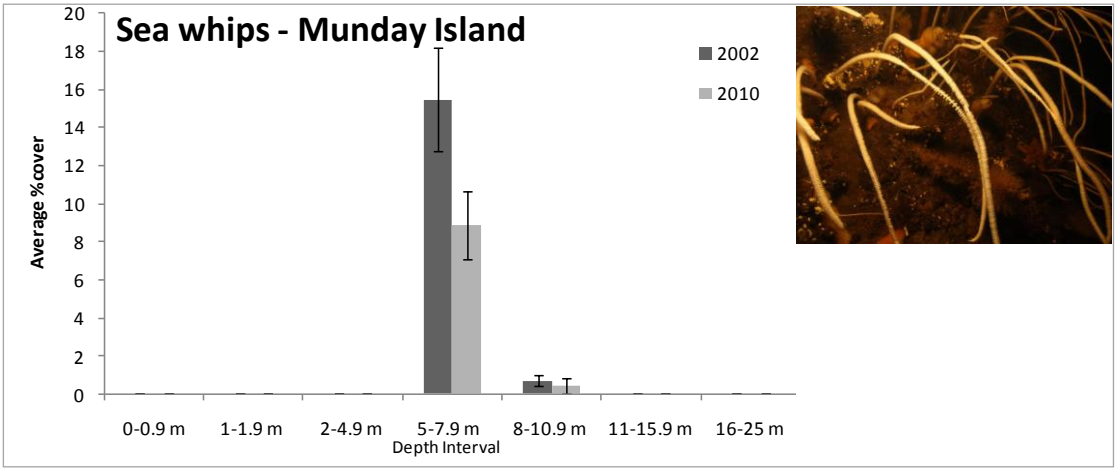

Fig. 3.14. The average cover of sea whips in 2002 and 2010 within each depth band over the 2 transects sampled at Munday Island.

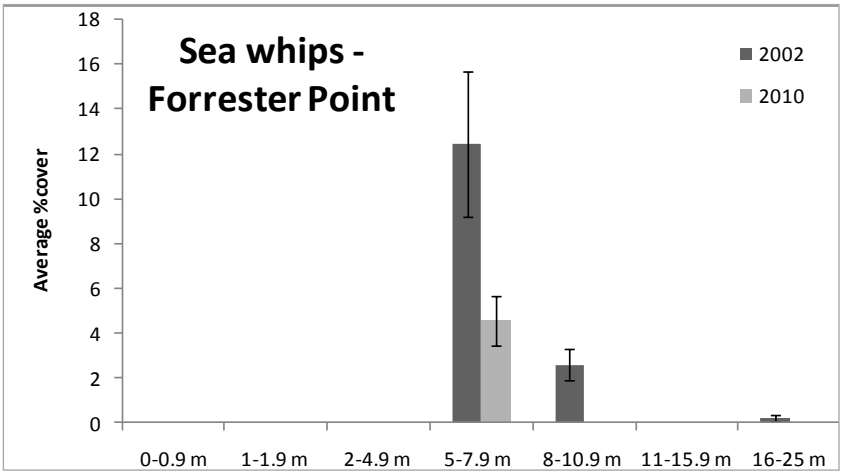

Fig. 3.15. The average cover of sea whips in 2002 and 2010 within each depth band over the 3 transects sampled at Forrester Point.

Whilst the soft octocorals of the genus *Clavularia* were a very common feature in the results for the 2010 data, the transparent nature of the animals (Fig 3.16), coupled with the lower resolution of the 2002 photo quadrats meant that it was only recorded in the similar abundance in the eastern channel, such as at Joan Point (Fig. 3.13d) where it has a pink morphotype. In 2010, their highest recorded cover coincided with sites and depths where sea whips occurred, between 5-10 m (Figs. 3.16 and 3.17). These small octocorals commonly averaged more than 30% of the cover on reef patches at moderate depths along the transects at Forrester Point and Munday Island in 2010, with the exception of the sandy transect 3 at Forrester Point (Appendix Tables 20-29).

Forrester Point also retained a moderate cover of cup sponges and yellow zooanthids of the genus *Parazoanthus*. The cover of yellow zooanthids at Forrester Point was greatest beyond 11 m deep in both 2002 and 2010 (Fig 3.18), and were present on transect 1 and 2. The overall cover was low, and estimated percentages in 2010 were quite variable, occurring on patches reef amongst sand. The greatest density of zooanthids recorded was 15% on transect 2 at 15 m deep (Appendix Table 22). The cover of cup sponges was also highest at deeper depths, particularly in the 16-25 m depth band for both years, and occurred over patchy silty

reef amongst the sand. The average cover appeared higher in 2002 for the 11-15.9 m depth band (Fig. 3.19).

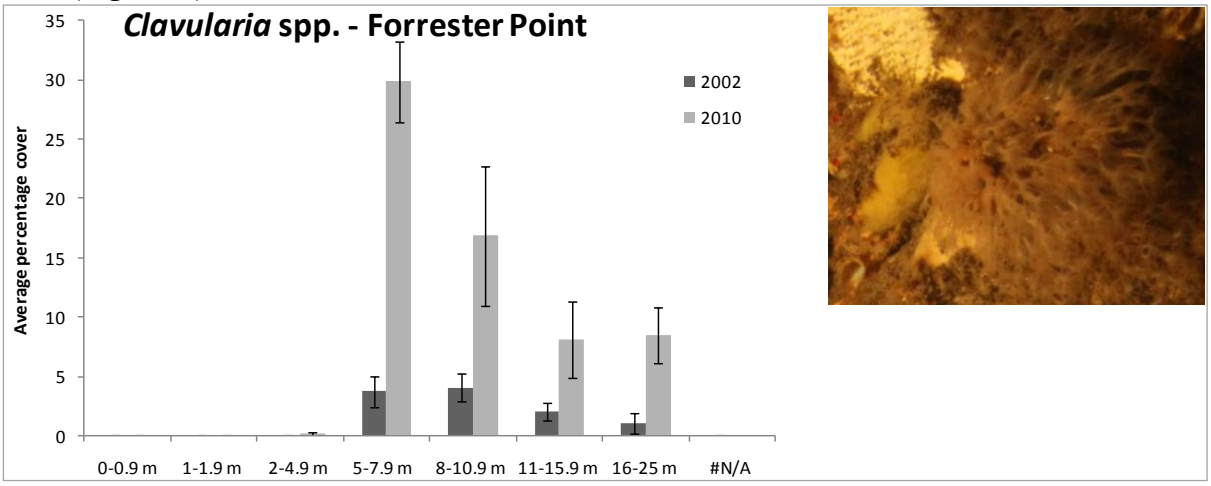

Fig. 3.16. The average cover of *Clavularia* spp. in 2002 and 2010 within each depth band over the 3 transects sampled at Forrester Point. Photo insert shows the transparent nature of the colony, which is hard to detect in low resolution photographs.

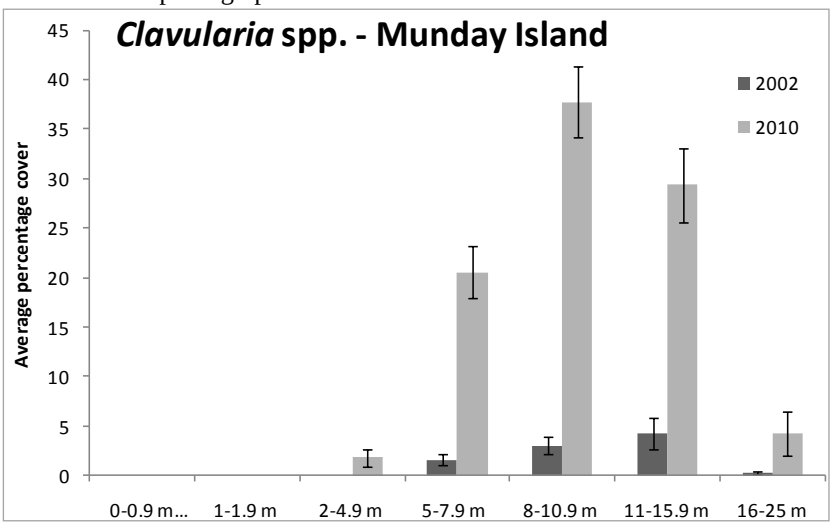

Fig. 3.17. The average cover of *Clavularia* spp. in 2002 and 2010 within each depth band over the 2 transects sampled at Munday Island.

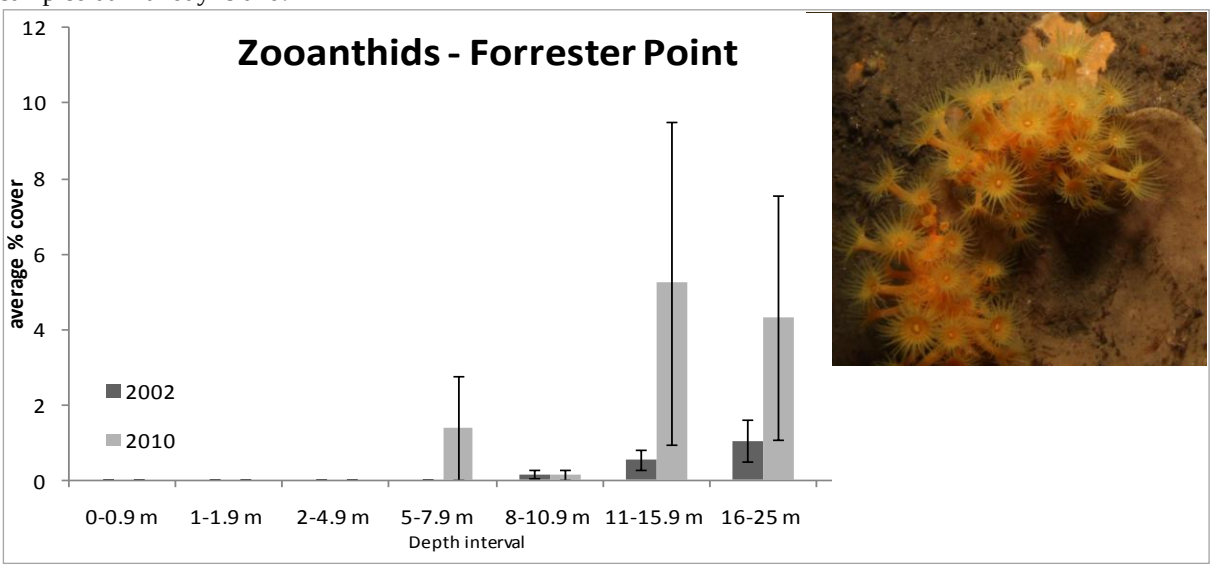

Fig. 3.18. The average cover of zooanthids in 2002 and 2010 within each depth band over the 3 transects sampled at Forrester Point.

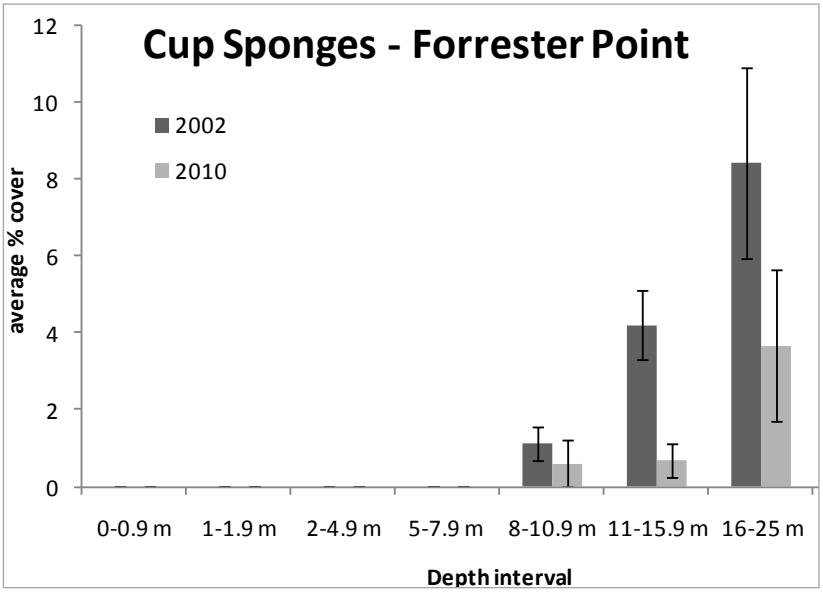

Fig. 3.19. The average cover of cup sponges in 2002 and 2010 within each depth band over the 3 transects sampled at Forrester Point.

3.3.3 The soft coral/bryozoan zone

In the third 'zone' of Bathurst Channel marine system, sea whips and dense growth of *Clavularia* octocorals are replaced by an abundance of soft corals of the genus *Drifa*, and there is an increase in bryozoan density. This included sites at Little Woody Island, situated in the middle channel, as well as Farrell Point, Joan Point and Eve Point which are sites further east, in a region where the channel restricts into a narrow pass. Within this 'soft coral/bryozoan zone', macroalgal growth contracted back to around the 2 m depth contour, with virtually no growth occurring beyond 5 m deep (Fig. 3.4), allowing invertebrate growth to dominate the reef substrate below two metres depth. Algae growing at shallow depths within this zone, such as *Hormosira banksii* and *Ulva* spp., presumably include species tolerant to low salinity episodes. Little Woody Island had the highest abundance of lace bryozoans whilst all sites within the zone had a high occurrence of *Drifa* spp. (Fig 3.20a and 3.20b). Eve Point, which borders the "soft coral/bryozoan zone" and the "barren zone" had comparatively high covers of solitary ascidians (primarily *Herdmania grandis*), mussels, anemones, and *Drifa* spp. (Fig 3.20 and 3.29). Transects at the new site at Farrell Point did not contain aggregations of lace bryozoans, but did have significant growth of *Drifa* spp. (Fig 3.20).

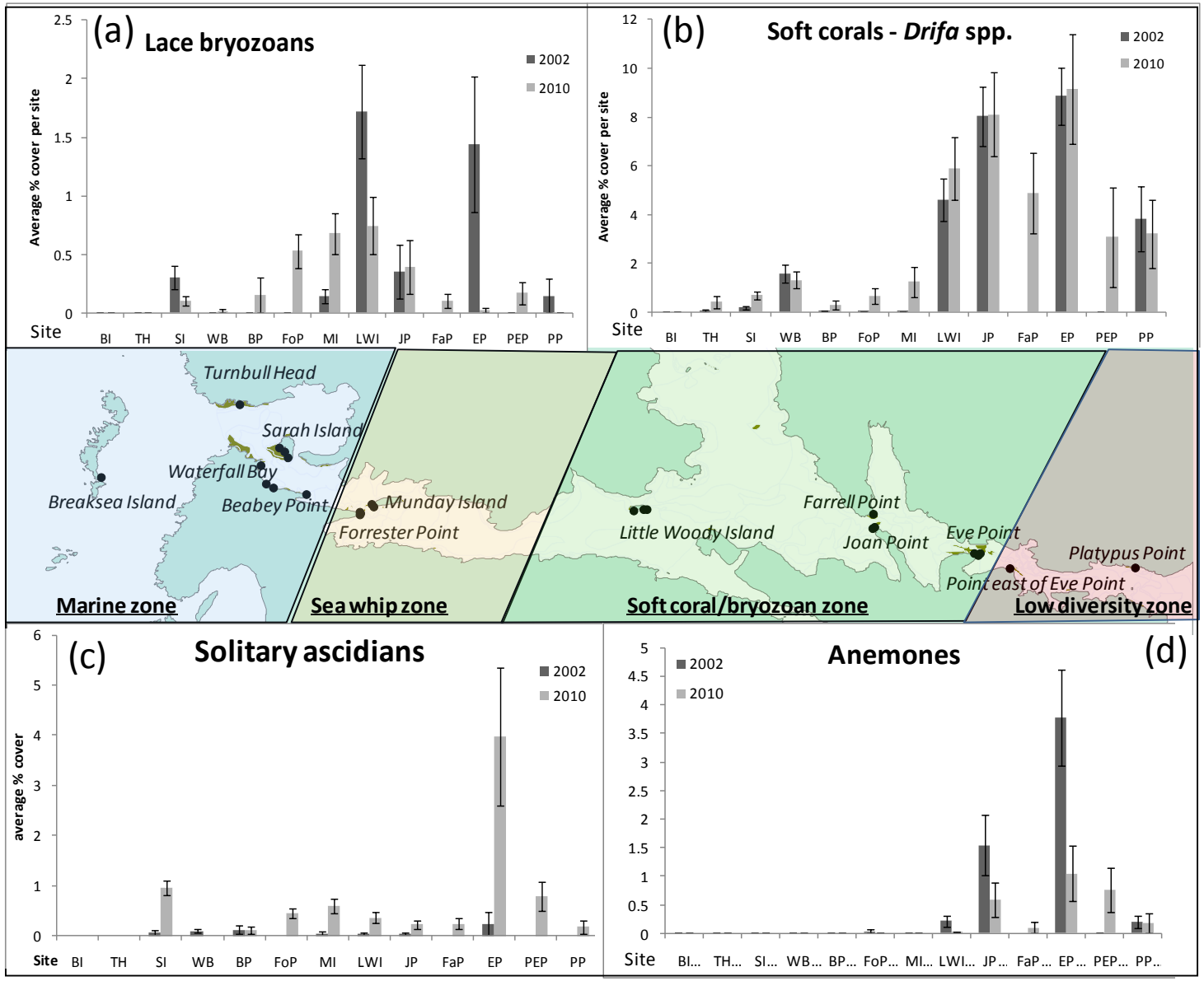

Fig. 3.20. The average percentage cover in 2002 and 2010 at each site surveyed in Bathurst Channel of: a) lace bryozoans, b) *Drifa* spp., c) solitary ascidians, and d) anemones. Site codes are as follows: BI= Breaksea Island, TH= Turnbull Head, SI= Sarah Island, WB= Waterfall Bay, BP= Beabey Point, FoP= Forrester Point , MI= Munday Island, LWI= Little Woody Island, JP= Joan Point, FaP= Farrell Point **, EP=Eve Point.
** *Farrell Point was not surveyed in 2002.*

Lace bryozoans peaked in abundance at 5-7.9 m deep, but also occurred at deeper depths. These occurred in similar abundances in 2002 to 2010 at Little Woody Island (Fig. 3.21). The most dense aggregations found in the Bathurst Channel sites occurred on transect 1 at Little Woody Island in both years at 5m deep, reaching a cover of 14% in 2002 and 13% in 2010 (Appendix 30). A high cover of lace bryozoans was recorded at Eve Point in 2002, but not in 2010. However the cover recorded was variable within each depth band (Fig. 3.22). In 2002, 2.7% cover was recorded at 5 m depth on transect 4, and 14.4% was recorded at 7m on the same transect which unfortunately was not a depth surveyed in 2010 (Appendix Table 47).

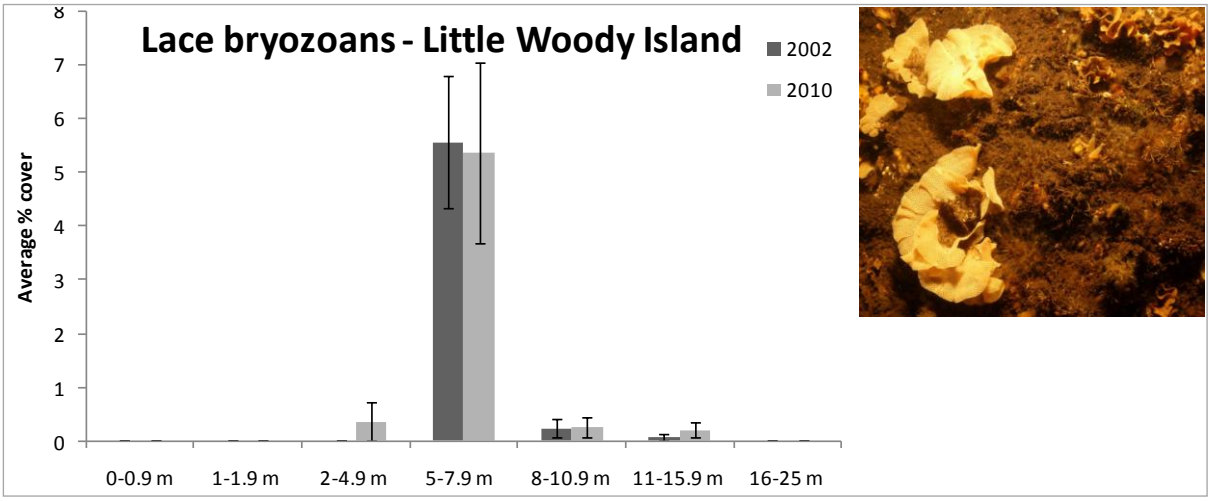

Fig. 3.21. The average cover of lace bryozoans in 2002 and 2010 within each depth band over the 3 transects sampled at Little Woody Island.

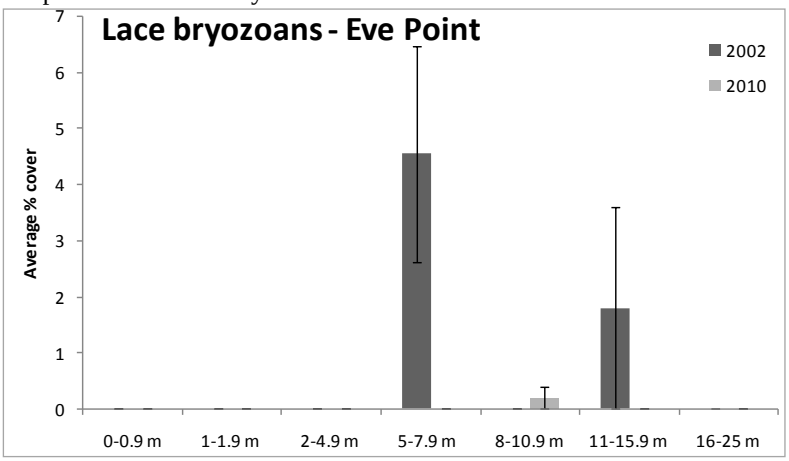

Fig. 3.22. The average cover of lace bryozoans in 2002 and 2010 within each depth band over the 2 transects sampled at Eve Point.

Soft corals of the genus *Drifa* spp. appeared to be particularly abundant in this part of the estuary. Patches of very high cover were found primarily between 3 and 5 metres, beyond the maximum abundance of macroalgae. Eve point had particularly high occurrences of *Drifa* at 5 m,which amounted to 46% cover on transect 4 and 71% on transect 3 in 2010 (Appendix 44). The recorded cover was lower in 2002, with estimates at 26% on transect 4 and 48% on transect 3 (Appendix Tables 45 and47). Overall the average cover of *Drifa* spp. was very similar between the two sampling years at the three most important sites for its occurrence: Little Woody Island, Joan Point and Eve Point, with slightly more occurring at Eve Point in 2010 (Figs. 3.23, 3.24 and 3.25).

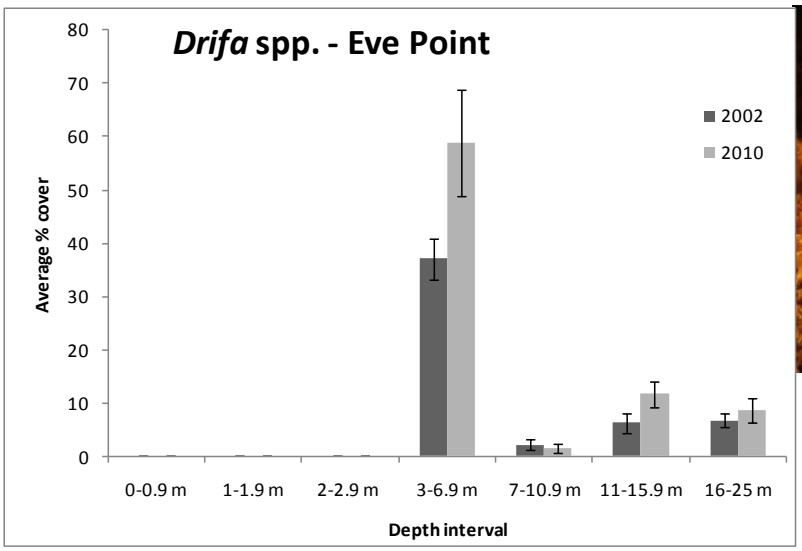

Fig. 3.23. The average cover of soft corals in 2002 and 2010 within each depth band over the 2 transects at Eve Point.

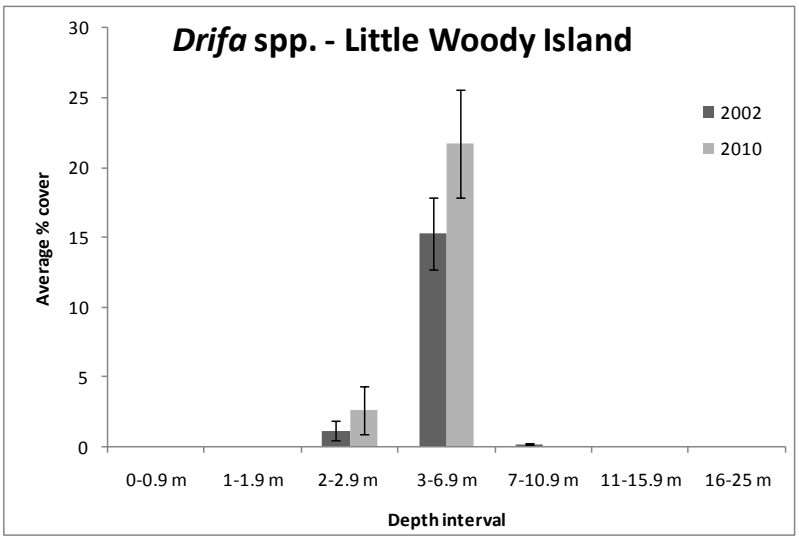

Fig. 3.24. The average cover of soft corals in 2002 and 2010 within each depth band over the 3 transects at Little Woody Island.

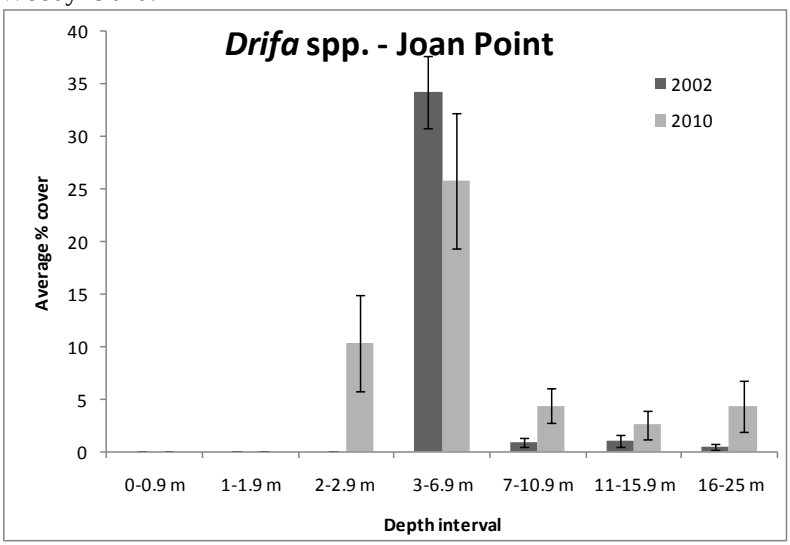

Fig. 3.25. The average cover of soft corals in 2002 and 2010 within each depth band over the 3 transects at Joan Point.

At Eve Point, there was also a high cover of filter feeding invertebrates in depths both above and below where *Drifa* soft corals dominated. This meant that Eve Point also had a high cover of total invertebrates in comparison to other sites surveyed within Bathurst Channel (Fig 3.29a). It is situated in a narrow restriction in "The Narrows" section of Bathurst Channel. Abundant species at Eve Point such as mussels, barnacles and the solitary ascidians *Herdmania grandis* are common constituents found in many estuarine habitats, and are capable of withstanding episodic changes in salinity. From 0-5 m deep, there were significant aggregations of mussels. The average cover of these mussel beds was similar for the 2-4.9m depth band in both years, whereas it was around 5% higher in 2010 in the 0-1.9 m depth band (Fig 3.26). Solitary ascidians also appeared in dense aggregations between 2 and 4.9 m, and the estimated cover detected in 2010 was significantly higher (Fig 3.27). Anemones also appeared at Eve Point and were found in similar abundance beyond 11m deep but were lower in cover for the 8-10.9 m depth band in 2010 compared to 2002 estimates (Fig 3.28). Both colonial anemones were present at Eve Point as well as solitary tube anemones, and these were intermixed with colonial octocorals, and soft corals in the deeper benthic community.

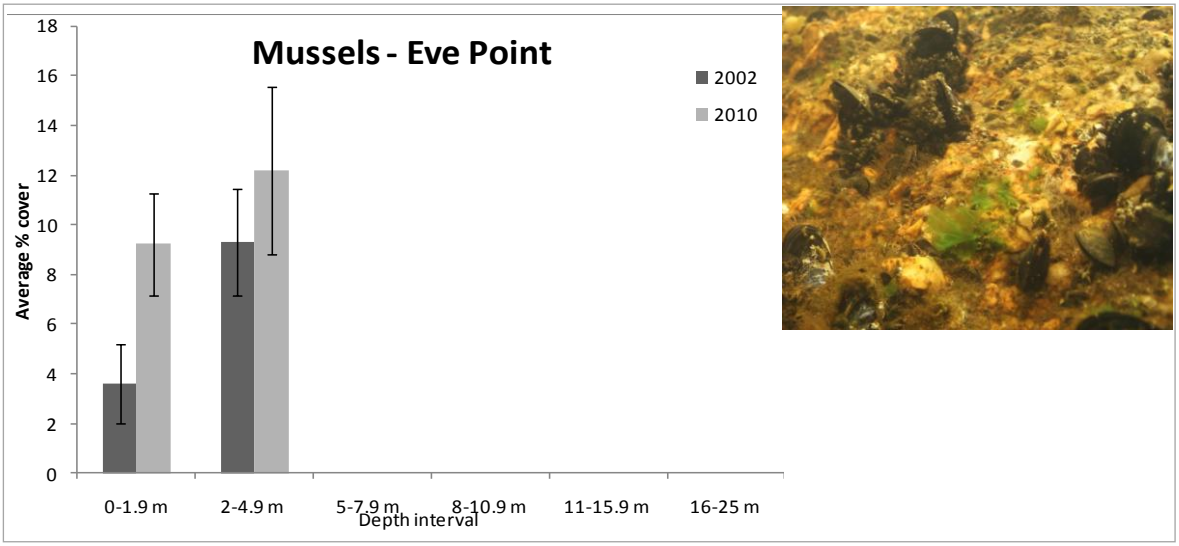

Fig. 3.26. The average cover of mussels in 2002 and 2010 within each depth band over the 2 transects at Eve Point.

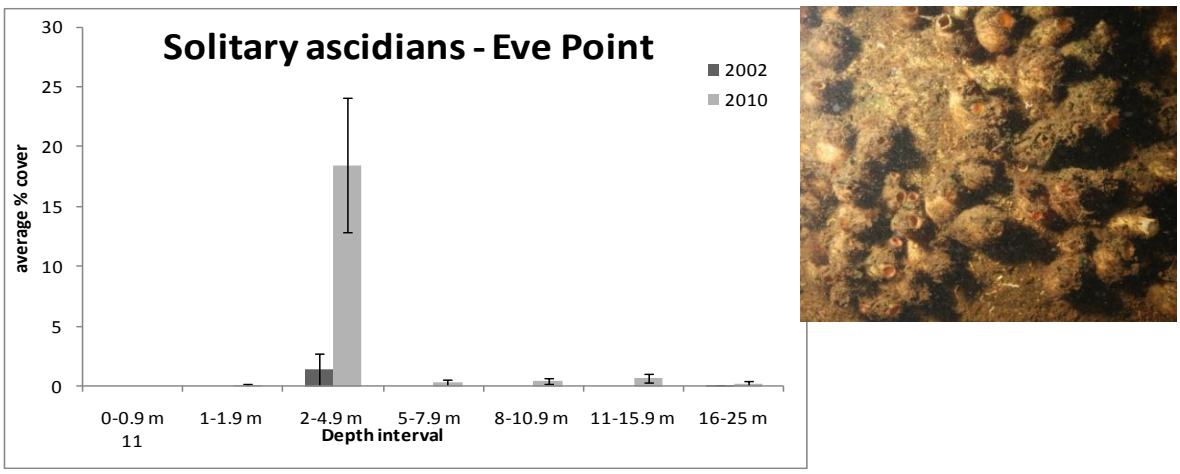

Fig. 3.27. The average cover of solitary ascidians in 2002 and 2010 within each depth band over the 2 transects at Eve Point.

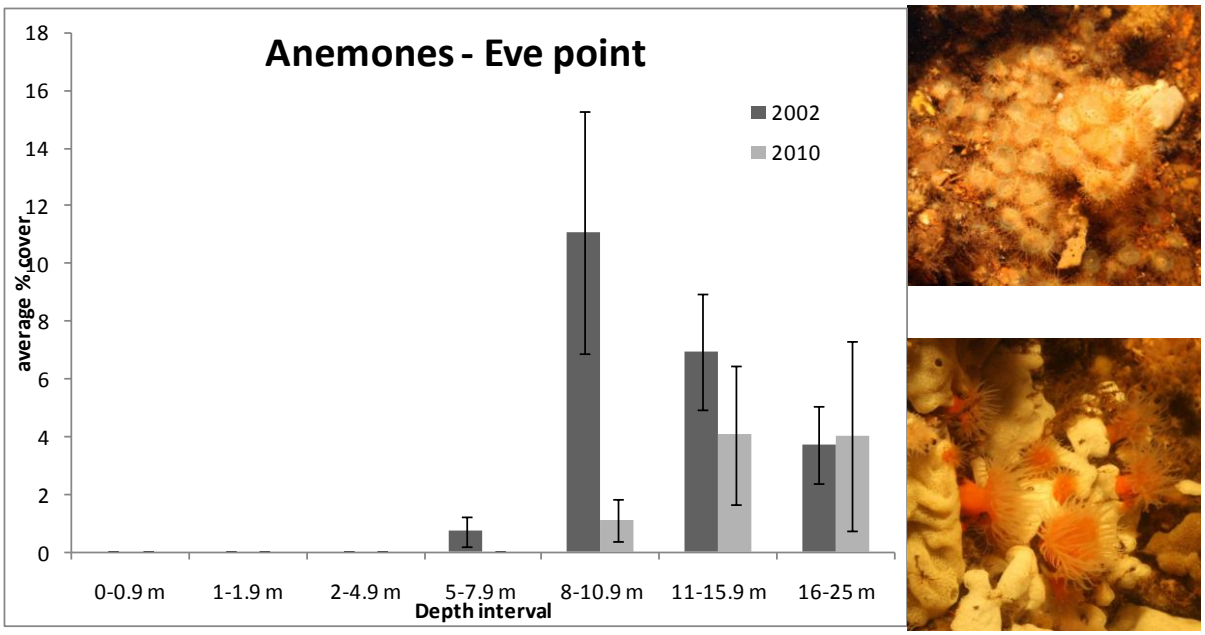

Fig. 3.28. The average cover of anemones in 2002 and 2010 within each depth band over the 2 transects at Eve Point.

3.3.4 The barren zone

The final most eastern zone of the Channel system included sites at Platypus Point and the Point east of Eve Point. These sites were characterized by a low overall cover of algae and invertebrates (Fig 3.4d and Fig 3.29a), hence the description as the 'barren zone'. All depths surveyed at these sites had a high percentage of bare substrate and/or biogenic substrate cover (Fig 3.29b), of which most was classified as 'algal/hydroid/silt matrix'. Presumably the mix of low nutrients, high tannin levels, decreased salinity and low plankton availability contribute to the comparatively barren benthic environment that is apparent at the two most eastern sites, as well as the areas susceptibility to episodic flooding events. Solitary corals did occur along this section of the estuary and appeared to be the most tolerant of these conditions but otherwise generally outcompeted at the sites further west. The average cover of solitary corals at Platypus Point was 5-6% at 11-15.9 m in 2002 and 2010 (Fig. 3.30). From 16-25 m the abundances were 3.7% and 0.4% in 2002 and 2010 respectively. In 2010 they were also recorded from Eve Point, where the photo below was taken. Dense mussel beds were abundant in 2002 at Platypus Point between 2 and 4.9 m, however these were not detected in 2010 at this site (Fig 3.31).

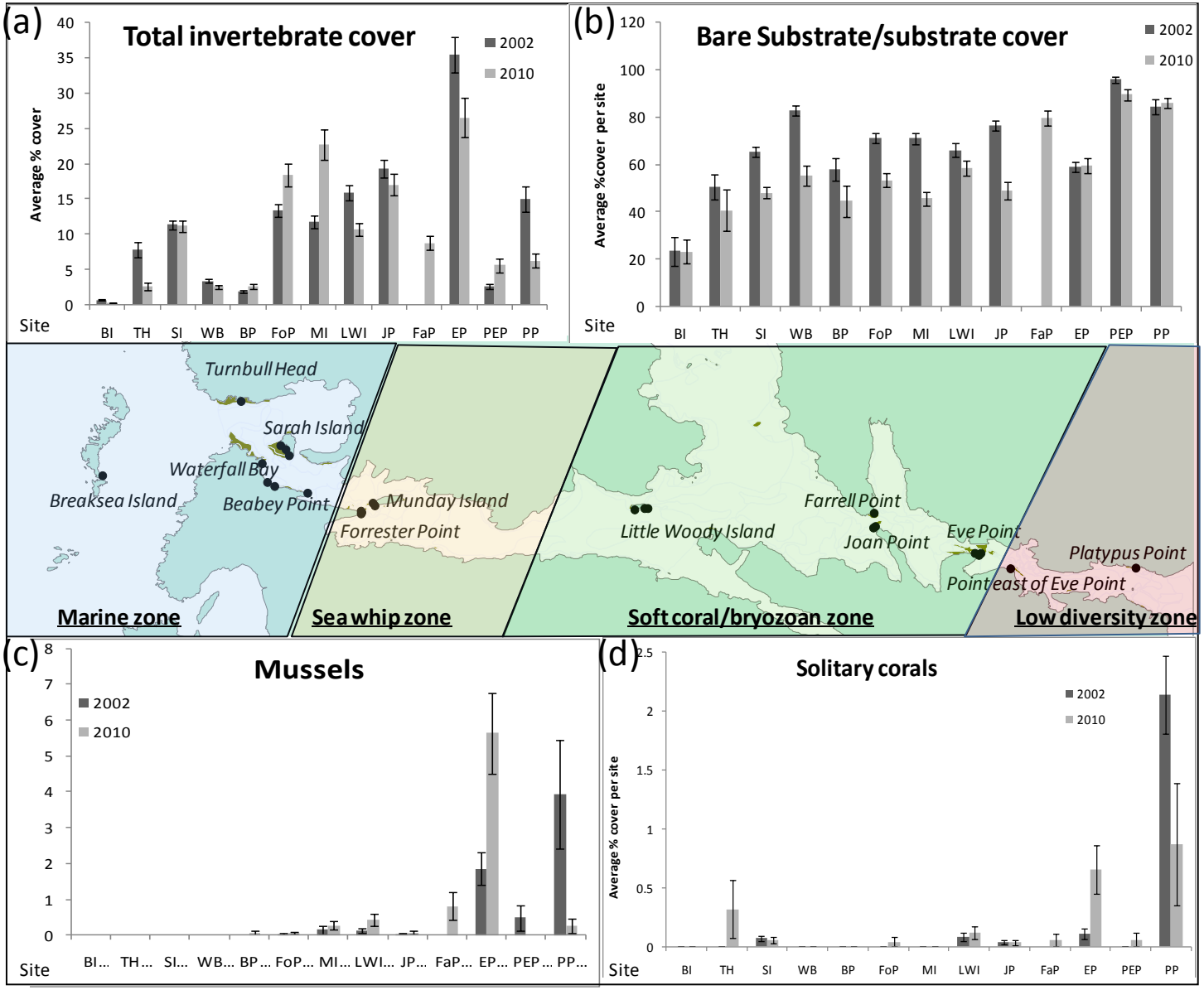

Fig. 3.29. The average percentage cover in 2002 and 2010 at each site surveyed in Bathurst Channel of: a) lace bryozoans, b) *Drifa* spp., c) solitary ascidians, and d) anemones. Site codes are as follows: BI= Breaksea Island, TH= Turnbull Head, SI= Sarah Island, WB= Waterfall Bay, BP= Beabey Point, FoP= Forrester Point , MI= Munday Island, LWI= Little Woody Island, JP= Joan Point, FaP= Farrell Point **, EP=Eve Point.

** *Farrell Point was not surveyed in 2002*

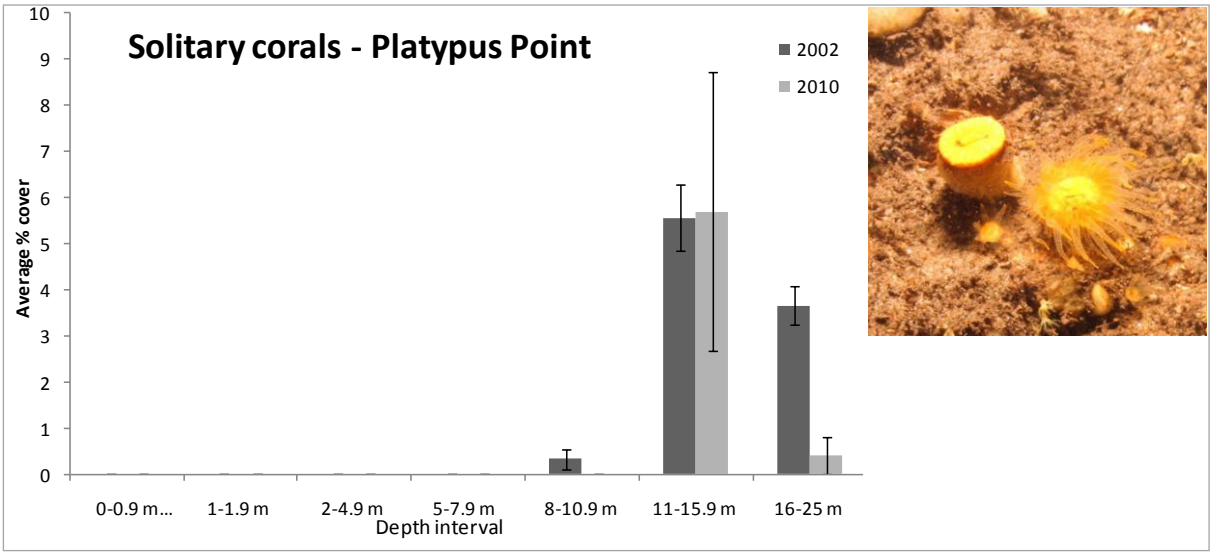

Fig. 3.30. The average cover of solitary corals in 2002 and 2010 within each depth band on 1 transect completed at Platypus Point

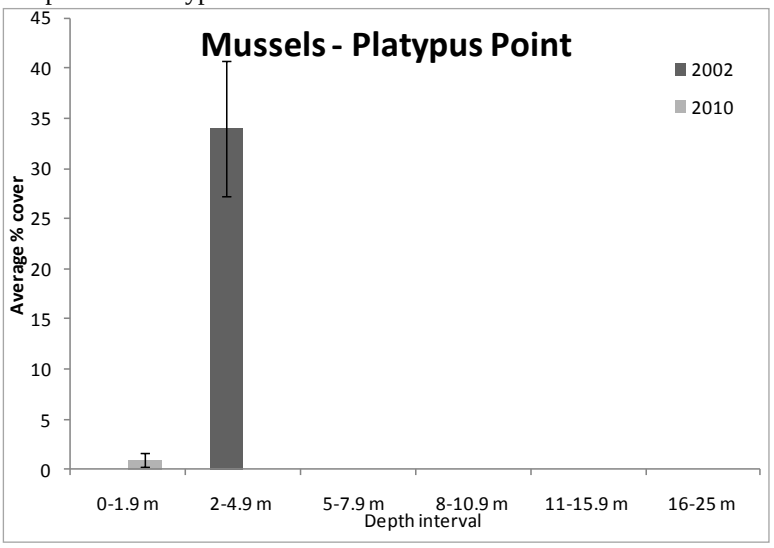

Fig. 3.31. The average cover of mussels in 2002 and 2010 within each depth band on 1 transect completed at Platypus Point

4. Discussion

4.1 Monitoring of the Bathurst Channel reef biota

An essential part of the management of the Bathurst Channel ecosystem is to establish a practical and quantitative monitoring program for its marine benthic communities. Although the area is remote, it is becoming more popular, with several hundred boat-based visitors arriving each year for sailing, sea kayaking and scuba diving, and many recreational and commercial fishing vessels using the harbour and channel area for shelter from the weather (Parks & Wildlife Service, 2009). The consequent potential for impacts and changes occurring from increased nutrient pollution, the establishment of introduced species, and climate change related temperature increases and salinity change is significant. These threats underpin the need for an informative and cost-effective monitoring scheme which ensures changes are detected, and which spans the variety of habitats and communities existing in the area. Importantly, employing the use of a suitable monitoring method also provides the opportunity to discover more about the biology and diversity of the poorly understood species within the area.

Bathurst Channel is protected as a no-take area within the Port Davey Marine Reserve, a multiple-use zoned marine protected area that was declared in 2005 to protect representative habitats within the Davey Bioregion, as well as the unique and fragile flora and fauna of Bathurst Channel and Bathurst Harbour. The Bathurst Channel no-take zone has restrictions on anchorage areas, shipping, waste-water discharge, a prohibition on fishing, and limitations on areas available for recreational diving, with several scientific 'reference areas' set aside to protect fragile sites and to act as reference areas to benchmark changes associated with diver-related impacts to fragile invertebrate assemblages. These protection measures have likely been successful in minimising anthropogenic physical/mechanical disturbances and resource depletion to the reef habitats. Minimising disturbance is especially important for the sessile invertebrates that are generally fragile and typically slow growing due to the low productivity of the ecosystem. This revisit to the area, 8 years after the last comparable survey and 5 years after protection within an MPA, has documented the persistence of the invertebrate assemblages within the Channel. It has shown that each of the monitoring sites have retained their previous assemblages and signature species, such as sea whips at Munday Island and Forrester Point, sea pens at Waterfall Bay and Sarah Island, as well as lace bryozoans and soft corals at Little Woody Island and Joan Point.

Previously within the Port-Davey-Bathurst Harbour region, a total of 46 microalgal species, 119 macroalgae, one seagrass, 609 macro-invertebrate species, and 102 fish species have been recorded (Edgar et al., 2010). Whilst the invertebrate fauna is considered diverse compared to other regions of Tasmania, the fish fauna is considered depauperate, and the seaweed flora is considered moderately diverse (Edgar et al., 2010). This array of species contains a large proportion of undescribed species, many of which have not been recorded elsewhere. This includes one fish species, *Microbrotula* sp., the cusk eel, which is endemic to the estuary, as well as the Maugean skate, *Zearaja maugeana*, which has only been recorded from Port Davey and Macquarie Harbour (Last and Gledhill, 2007). During previous surveys targeted at collection biological specimens, many species have only been sighted on one occasion (79% of invertebrate and algal species) indicating the presence of unexplored biota in the region (Edgar et al., 2010). Future monitoring using the methods

employed in this study will continue to provide the opportunity to document new species and provide more information on the stability of the species already recorded form the area. Such monitoring in combination with other techniques focussing on soft sediments/deeper water will also provide a better overview of the unique biology of the area.

4.2 Environmental and biological influences on species distribution

Very little is known about the biology of many of the Bathurst Channel invertebrate species, their tolerances to environmental change and their potential responses to habitat invasion from new introduced pests. By looking at the species distribution over different sites and depths we have gained some insight into the limiting environmental and biological factors affecting competition, growth and survival. From a management perspective, such information also highlights which species may be most affected by environmental change, for example those with a very limited distribution within the channel, and flags sites which are particularly important for conservation of species.

The spatial distribution of species over the monitoring sites clearly followed an environmental cline from west to east where the water becomes less productive, less marine influenced, more stratified and more influenced by tannin-stained freshwater and episodic flooding into the estuary. This appears to alter the depth distribution of the benthic community as well as the distribution of species throughout the channel (Barrett *et al.*, 2002). In general, changes in light attenuation, exposure and salinity governed the algal species present throughout the channel and their depth distribution, whilst current, salinity, planktonic food availability, and competition with algae for space, influenced the invertebrate species present. Moderate depths of 3-5 m appeared to harbour the highest density of invertebrates in areas where light availability restricts algal growth. Bathymetry and geomorphologic variation throughout the system have an effect on current strength and the rate of sediment deposition (Barrett *et al.*, 2002), with sites such as Eve Point and Joan Point having a higher current than surrounding sites due to a restriction in the channel geomorphology. These high current zones harbour a dense growth of the soft corals *Drifa* spp., and a diverse array of organisms compared to adjacent sites in the eastern channel.

Within the western 'marine zone' of Bathurst Channel, the community types found at each site appeared relatively stable between the two years surveyed, and many of the associated species, such as the habitat forming kelps, are found elsewhere in Tasmanian waters. In this zone a macroalgal dominated community was persistent at shallow depths, with species distributions in 2010 being identical to those reported in 2002 (Barrett *et al.*, 2002). Exposed sites were dominated by the kelps *Durvillea potatorum* and *Ecklonia radiata*, with *Macrocystis pyrifera*, *Xiphophora gladiata* and *Lessonia corrugata* also occurring. Overall, communities in this marine zone appeared to be amongst the most diverse and productive of those found within the Bathurst Channel system (Barrett *et al.*, 2002; Barrett and Edgar, 2010). The primary determinants of species occurrence and distribution in this section of the system appear to be exposure and light availability for the algae. Although reefs in this area are closer to a typical reef community in Tasmania, the influence of freshwater tannins is still strong, restricting most brown algae to depths of 5m or less, with algae at greater depths being primarily red algal species. At these depths the community was usually dominated by the red algae *Thamnoclonium dichotomum*. This pattern is consistent with that previously recorded for the area for algal communities found at 5 m from Turnbull Head to Munday Island (with the exception of Waterfall Bay) by this species.

For the invertebrates in the 'marine zone', competition with algae for space and planktonic food availability appear to limit growth. Sarah Island stood out as a particularly diverse site, and an important one for sessile invertebrates such as soft bryozoans, cup sponges and sea pens, gorgonian fans and bramble corals. Some of the invertebrate species, such as sea pens and the gorgonian *Pteronisis plumacea,* appeared to be competitive in the marine dominated conditions but were absent further east where salinity levels fluctuate and the effect of tannins is extremely strong. At Waterfall Bay, which represented a more sheltered site within this region, the presence of bare sand and tannins presumably allowed the deep water emergence of sea pens. More commonly observed below 25 m, sea pens were distributed between 5 and 15 m on the sediments within the bay. The community composition at Waterfall Bay stood out from the rest of the sites, having a high proportion of sandy substrate, lower cover of algae and total number of biota than the rest of the marine zone sites. This was primarily because this site was chosen to monitor the most extensive population of sea pens known within the Channel, rather than be a reference site for reef habitats and reef associated species.

As the channel progresses further east, conditions become more stratified and freshwater-influenced. Whereas many estuaries are most productive in their mid-section, this area of Bathurst channel is contrastingly low in productivity presumably due to a combination of reduced light, low levels of freshwater nutrients entering and reduced water mixing. There appeared to be a loss of many algal species associated with the marine zone such as *Macrocystis pyrifera*, *Xiphophora gladiata*, *Lessonia corrugata* and *Durvillea potatorum*. The more sheltered water species *Hormosira banksii* as well as *Carpoglossum confluens* replaced *D. potatorum* in the intertidal depth ranges. Reduced competition with macroalgae in the subtidal depths beyond 3 m was the likely cause of the appearance of a diverse array of invertebrates such as sea whips, lace bryozoans, tube-building polychaete worms, cup sponges and zooanthids in the "sea whip zone" and the "soft coral/lace bryozoan" zone. Interestingly, in the "sea whip zone," soft coral of the genus *Clavularia* was prevalent but was seemingly outcompeted further east by *Drifa* spp. of soft corals, presumably as they were more tolerant to the lower or fluctuating salinity levels.

The presence of a strongly stratified fresh water surface layer in the section of Bathurst channel known as "the Narrows" restricts species that are intolerant to low salinity and low light conditions. This effect was greatest at the 3 most eastern sites which were dominated more by 'opportunistic' species of sessile invertebrates common to estuaries, such as mussels and solitary ascidians. Such species tend to be fast growing but may have a highly variable abundance depending on the conditions present at a particular time, and on episodic events such as freshwater flooding into the estuary. Other species which persisted in the eastern channel were anemones and solitary corals, often in the deeper, more marine influenced waters. All these species tended to have a higher abundance at Eve Point, where a restriction in the channel morphology causes higher currents, presumably delivering more planktonic food. The two most eastern sites were the most barren, with bare substrate and turfing substrate cover providing more of the total cover than algae and invertebrates combined. At these sites, *Ulva*, a species commonly abundant in low salinity areas (Barrett and Edgar, 2010), as well as the brown algae *Hormosira banksia*, appeared well adapted to the environmental conditions found there.

4.3 Changes in biotic assemblage in light of the new monitoring methods

The choice of digital image collection over *in situ* species identification meant the cost efficiency of undertaking the surveys in a remote area is greatly decreased, and that access to divers with suitable knowledge of benthic flora and fauna is not necessary. However, by using this approach there is a trade off with the ability to detect species that may be small, camouflaged or dark in colour, or covered with sediment or algal canopy. It also restricts the identification of species that are poorly represented in pictorial species identification resources. This is true for many of the sponge and ascidian species, but not for many of the iconic deep water species of interest which were generally less cryptic. Nevertheless the development of the species catalogue allows for the opportunity of later identifying species through targeted collections after the improvement of taxonomic resources, and increases the potential versatility of the data into the future. The use of CPCe software allows the creation of permanent data files where each point is overlayed, referenced, and stored so that assignment of species can be later efficiently queried, edited and the files updated. Since 2002, advances in the technology used to collect and process image data has likely improved the detection of many species allowing for more standardised analysis methods for comparison with future monitoring. On the whole, differences between biological communities and sites recorded from the 2002 and 2010 surveys resulting from slightly differing image recording and image scoring methodologies were minimal. Some unforeseeable inconsistencies in the abundance estimates of a few species were apparent, and these were likely to be caused by either differences in image quality, insufficient replication, or expertise of the person undertaking the image analysis.

Due to differences in image quality, there were some limitations in undertaking precise statistical comparisons of species percentage cover with 2002 monitoring data. The high concentration of tannins in the water of Bathurst channel does introduce difficulties with the collection and use of digital image data. In 2002 it was not possible to photograph 0.5m x 0.5m quadrats due to light path issues, which are particularly problematic at shallow depths in the eastern region of the channel. Photo quadrats were instead constructed from stills of video imagery taken along transects, with the selection of still images from the videos, as well as the subsequent analysis of images being undertaken by same biologist who collected the imagery. Having seen the sites *in situ* was an advantage during the analysis of imagery, as well as having video records to resolve some uncertainties when categorising photos with poor resolution. Due to the absence of appropriate software at the time, no permanent records of the assignment of species to each point on the overlayed grid (using Microsoft PowerPoint) on each replicate were kept from the 2002 survey. However, all the images used in 2002 were retained, along with images of reference species. In contrast to this, in 2010 high resolution wide angle photos were taken, and the effect of tannins in the eastern channel was clearly much less on the quality of the image. Images were analysed in CPCe by two separate biologists with sufficient knowledge to assess benthic biota, but neither of whom collected the data in situ diving in Bathurst Channel. CPCe overlays points in a grid pattern over each photo, rather than a grid made up of intersecting lines as was used in 2002, making the assignment of species to a point likely to be more dependent on the size of the point (the bigger the point overlayed on the photo the more likely it is to hit a discernible object such as a slender sea whip surrounded by a background of algal turf).

The changes in the methods used to census digital imagery, coupled with the significant increase in image resolution between years certainly resulted in some differences in the detection of a few species. This was particularly apparent for the more transparent individuals

of the gorgonian *Clavularia* spp. which may have been underestimated in the analysis of 2002 imagery due to the poorer resolution of the images, but were found to be very common in the 2010 results. It is also likely that the number of sponges and ascidians that were differentiated was higher in 2010 than 2002 due to a significant increase in our ability to examine the fine scale features of each sponge. On the other hand it appeared that the detection of the bivalve *Barbatia pistachio,* (which are most often covered in sediment and appear as a dark shell on a dark background) was under estimated in 2010 relative to 2002 due to the earlier scoring being obtained from freeze frame video, where movement of the *Barbatia* shells gave a significant clue to their presence, resulting in higher detection levels. Despite this drawback, the use in 2010 of a method which is consistently repeatable by a range of biologists also has its advantages in eliminating personal biases during the analyses, as well as the use of data throughout a longer term monitoring program where personnel are likely to change. The latter method is now widely used for scoring imagery taken in deep water around the Tasmanian coast as part of research undertaken within the CERF and NERP Marine Biodiversity Hubs, allowing for direct quantitative comparison of different habitats while sharing a common species list and photographic reference library. The protocols for this methodology are reported in detail in Meyer *et al.* (2011).

Whereas time constraints meant that not all replicates were analysed in 2010, it is likely that an increase in the amount of replicates analysed overall would also allow for more consistent abundance estimates. The collection of data spread within specific depth bands of 2-3 m in future surveys may also compensate for small differences in transect placement and tidal levels at the time of sampling, particularly for species which occur at very specific depths, or are very patchily distributed. For species such as sea pens which are very iconic but occur patchily on soft sediment habitat in low density, increased replicates or targeted *in-situ* searches may be important in order to gain better abundance estimates, particularly as sea pens retract below the surface when disturbed or in response to the direction of tidal flow (Barrett *et al.*, 2002).

Taking into consideration the differences between methods between years, a few notable changes in abundance were apparent between the two surveys. The most significant of these was a marked decrease in the cover of sea whips at depths between 5-7 m at Forrester Point from around 13% cover in 2002 to around 4% in 2010, with a similar decline also being detected at Munday Is. These sites are essentially the "hotspots" of sea whip distribution in the system, so this decline represents a notable change in a key feature of the region. There was sufficient replication of imagery, and good image quality in both surveys, so the decline is most certainly a real change, rather than one related to differing methodologies used for analysis. At the time of the 2010 surveys, divers noticed that the whips had both declined and were in a relatively poor condition, with some cover of epiphytic red algae. A likely cause of the observed decline therefore is that the whips have died off as a result of increased water clarity allowing algae to grow deeper than normal and overgrow the invertebrate assemblage that usually does not have to compete with algae. This pattern has been regularly (and seasonally) observed in the D'Entrecasteaux Channel (N. Barrett- Pers. Obs.). The 2010 survey coincided with a lengthy drought in Tasmania that would have resulted in lower than normal river flow and therefore much reduced tannin levels within Bathurst Harbour and Bathurst Channel. These lower tannin levels, in turn, result in much greater light penetration in the water column, increasing the depth to which seasonal algal growth can occur. This pattern would likely have been responsible for a number of other declines in species that occupy the depth band where algae and invertebrates may strongly interact between years.

Another notable characteristic of our temporal comparison was the variable nature of 'opportunistic' species in the shallow areas in the estuarine eastern channel, such as mussels and solitary ascidians. Such species are commonly found in estuaries and the appearance and disappearance of dense stands are somewhat more understandable considering the variability in environmental conditions in the eastern channel where they were distributed. Presumably these shallow water species are particularly susceptible to freshwater flooding events that must kill them if the events are sustained over week length periods. The cover of these species appeared to be spatially patchy, which could reflect opportunistic recruitment success during more optimal conditions.

5. Conclusion

This monitoring survey confirms the temporal stability of patterns in community composition previously described for the general distribution of biotic assemblages in Bathurst Channel. It was based on the use of a standardised photographic and image analysis method which is highly suitable for long-term monitoring of this unique ecosystem. This method allows for efficient data collection in a remote area, storage of permanent data records and readily repeatable methodology for the analysis of imagery. While the methodology used was a departure from that utilised for analysis of the original 2002 survey, and resulted in some potential method-related bias, it better reflects the significant advances in imaging and analysis technology that have occurred over the past decade and provides a sound basis for future surveys utilising similar high resolution imagery. The species reference images and biota categories used in the 2010 analysis have been stored for further reference, including the matching of codes from 2002 data. The reference imagery and biota categories form a component of a wider image-analysis capacity at IMAS whereby the same methodology and species reference library can be applied to standardise analysis from estuaries to deep reefs. This is an integral part of establishing baseline methodology, so that direct comparisons of species abundance can be reliably and efficiently made into the future, and be broadly applicable at local, regional and national scales.

Comparisons between 2002 and 2010 for overall biotic patterns throughout the system show a consistent distribution of representative and characteristic macroalgae and marine invertebrate species over the years at the sites monitored. However, the results also show some significant differences in abundance for certain species between the two years. These differences are often related readily accounted for by method related bias (e.g. *Barbatia*), timing of surveys relative to tidal flow (sea pens) or environmental variation for some of the more 'opportunistic' estuarine species such as mussels, red throat ascidians and barnacles that are primarily situated in the eastern section of the channel. Some species of interest (e.g. lace bryozoans) were patchily distributed with a relatively low abundance, thus the variation in estimated cover was high relative to the changes detected. If estimates of these species are to be improved on further surveys, additional replication at the transect scale may be required. The most notable genuine change detected between 2002 and 2010 was a significant decline in average abundance of sea whips at Munday Island and Forrester Point, representing an average decline of around 50% in the cover of sea whips at the 5 m depth category. This decline is almost certainly related to a prolonged period of drought leading up to the 2010 survey, which resulted in reduced tannin levels via less river runoff, and hence less protection of the invertebrate assemblages against algal overgrowth. The variability in rainfall in response to a changing climate may be a significant driver of change in the Bathurst Channel

invertebrate community over the next century, with this community being particularly sensitive to such changes.

Continued periodic monitoring of the sites included in this survey, allowing for sufficient replicates to document any major changes in the abundance of key species, such as sea whips, is recommended in order to better understand patterns of natural variability, and separate these from potential human impacts, with results feeding into the management process to maintain the biological values of this unique ecosystem.

6. Acknowledgements

This project was initiated by Michael Driessen (World Heritage Area Zoologist) in response to concerns about the potential impacts of increasing visitation levels in Bathurst Channel. The project was funded by Australian and Tasmanian governments through the Tasmanian Wilderness World Heritage Area fauna program, with in-kind support being provided by IMAS, including the use of laboratories and image analysis equipment used for preparation of the report. We wish to thank Sam Ibbott, master of the vessel "Schouten Pass' for vessel support for the survey and PWS staff, including Albert Thomson and Mike Garner, for access to the PWS Mellaleuca base and the vessel Raja for the duration of the survey. Finally, the CERF Marine Biodiversity Hub provided the necessary image analysis framework to allow this work to fit within a standardised framework, and we thank Nicole Hill for developing the framework and Peter Walsh for developing the associated database to act as repository for our raw imagery and analysis products.

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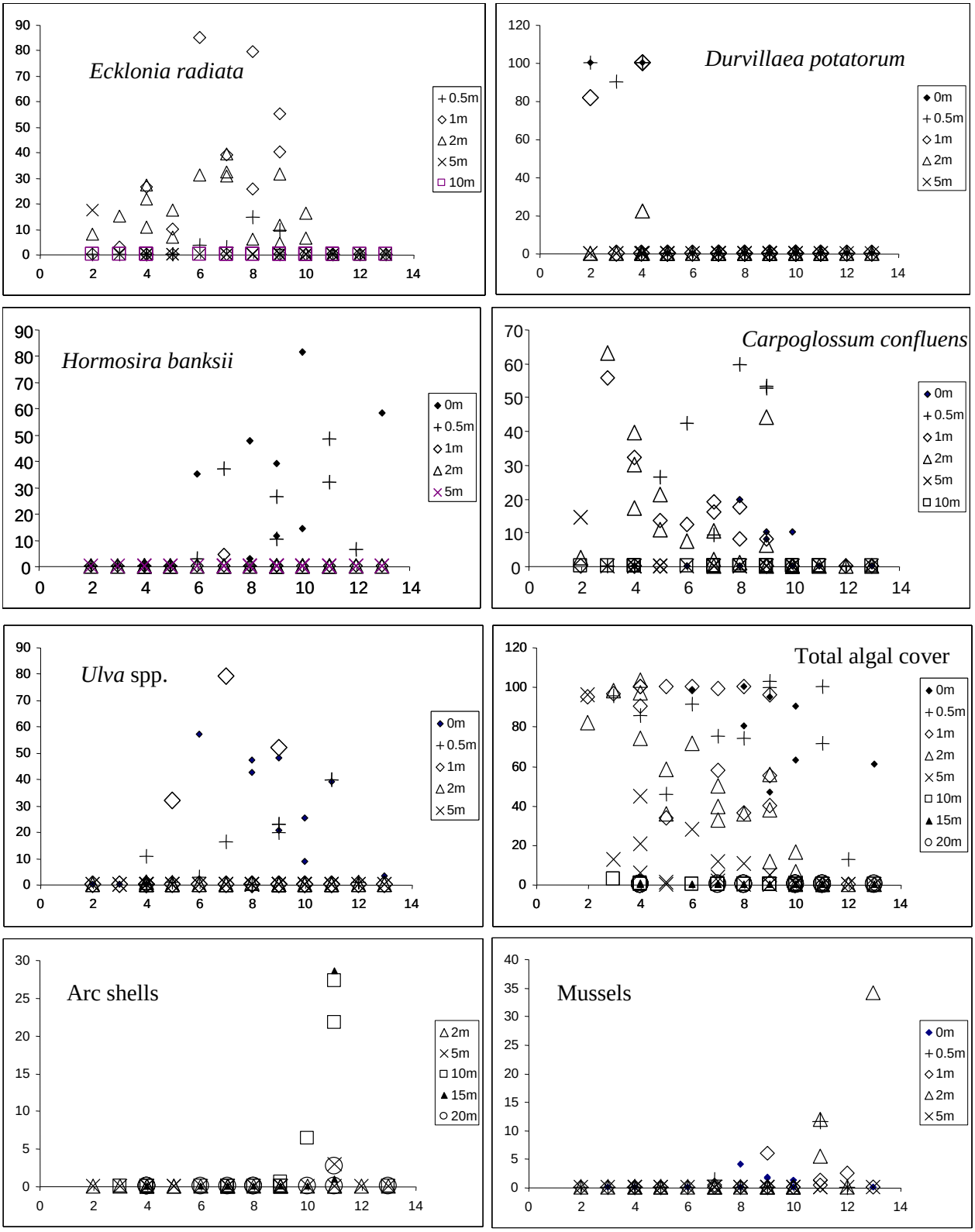
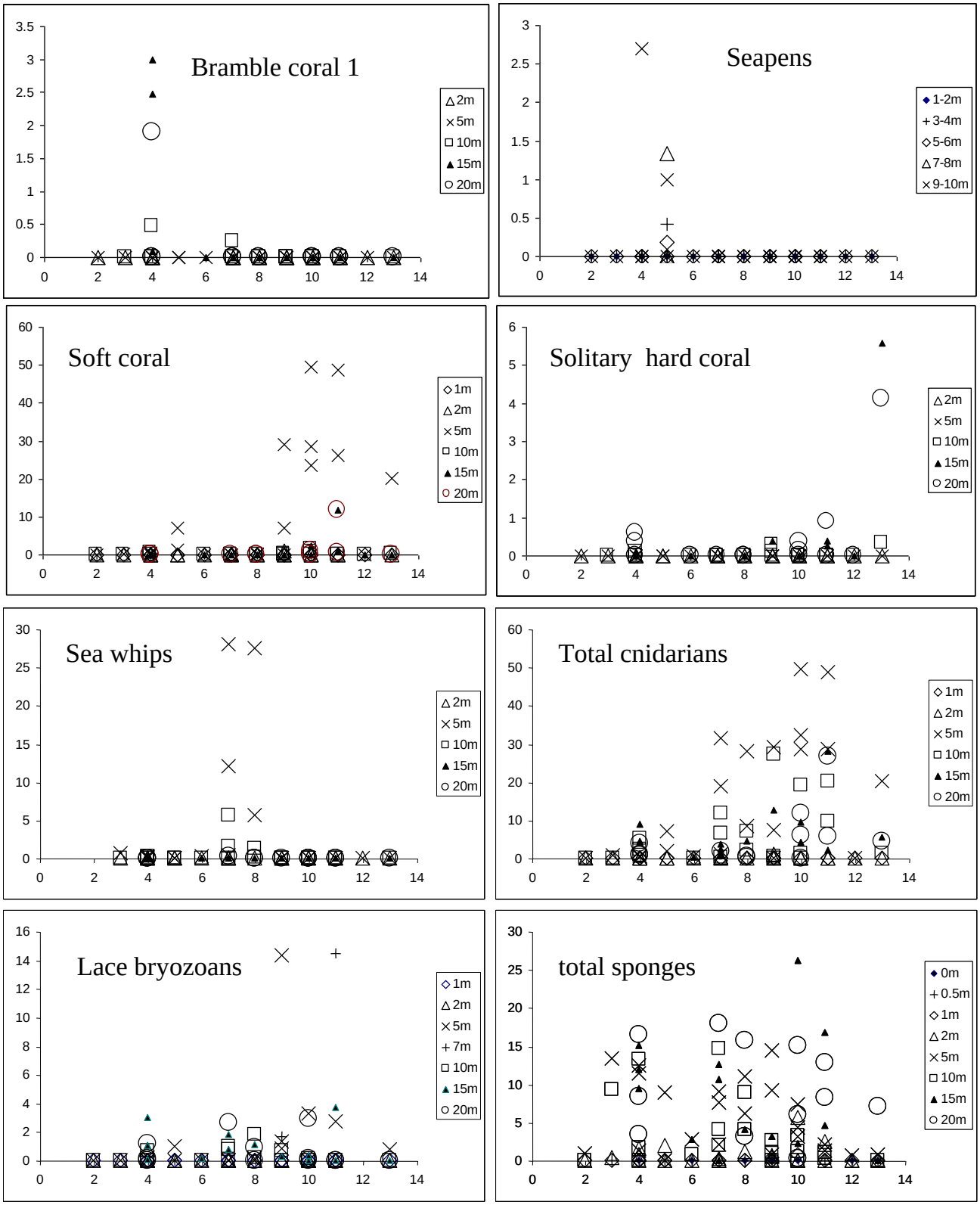
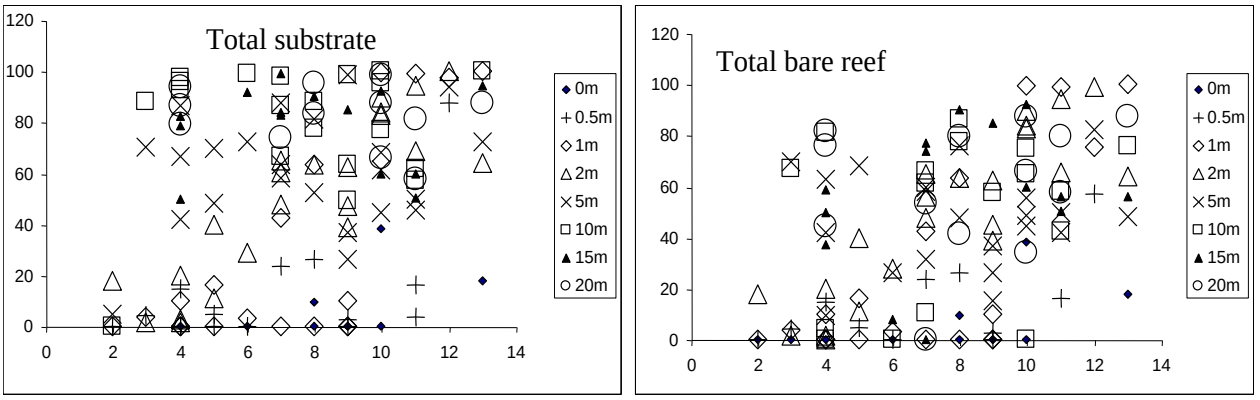
8. Appendix



Appendix Fig. 1. Mean percentage cover of algal and mollusc species by depth identified from sites in Bathurst Channel and the surrounding coastline surveyed by quantitative video-quadrats in October/November 2002. Some sites have multiple transects and not all depths were surveyed at each site (see tables 2-25 for depths surveyed on each transect at each site).



Appendix Fig. 2. Mean percentage cover of invertebrate species by depth identified from sites in Bathurst channel and the surrounding coastline surveyed by quantitative video-quadrats in October/November 2002. Some sites have multiple transects and not all depths were surveyed at each site (see tables 2-25 for depths surveyed on each transect at each site).



Appendix Fig. 3. Mean percentage cover of bare substrate by depth identified from sites in Bathurst Channel and the surrounding coastline surveyed by quantitative video-quadrats in October/November 2002. Some sites have multiple transects and not all depths were surveyed at each site (see tables 2-25 for depths surveyed on each transect at each site).

Appendix Table 1. Quantitative estimates of percentage cover at Breaksea Island T1 in 2010

Breaksea Island T1														
					Depth									
					0.5m		**1m**		**2m**		**5m**		**10m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Algae	Brown algae	Carpoglossum confluens	CAR	car					16.40	16.40	10.36	6.94		
		Durvillea potatorum	DUR	dur	99.12	0.54	87.60	8.95						
		Ecklonia radiata	ECK	eck					35.59	17.45	38.44	3.02		
		Lessonia corrugata	LES	les					13.78	13.78				
		Phyllospora comosa	PHY	phy			12.40	8.95	15.87	12.80				
		Xiphophora gladiata	XIP	xip							0.95	0.95		
	Green algae	Caulerpa sedoides	NB52	NA							1.29	0.84		
	Red algae	encrusting coralline	ECO	enc					7.87	3.36	8.90	1.07		
		encrusting plate coralline	EPCO	epc							1.33	0.87		
		Foliose red algae	FORE	fore							0.48	0.48		
		Gelidium australe	NB51	NA					4.18	2.61				
		Peyssonnelia spp.	PEY	pey							16.52	5.96		
		Phacelocarpus pepperocarpos	PHA	pha					1.24	0.81				
		Thamnoclonium dichotomum	THAM	tham							4.35	2.70		
	Unidentified algae	Unidentified algae	UNA	unka					1.74	1.07				
		Unidentified algae - foliose	FOL	NA							0.95	0.58		
Algae Total					*99.12*	*0.54*	*100.00*	*17.91*	*96.67*	*68.26*	*83.57*	*23.40*		
Other Cover	Other Cover	Algal turf	TURF	NA							1.90	1.17		
		Biogenic Matrix	MATR	NA					2.93	2.08	14.04	3.10	0.40	0.40
Other Cover Total									*2.93*	*2.08*	*15.95*	*4.26*	*0.40*	*0.40*
Sponges	Arborescent sponges	Arborescent sponges	-	-					0.40	0.40				
	Encrusting sponges	Encrusting sponges	-	-							0.48	0.48		
Sponges Total									*0.40*	*0.40*	*0.48*	*0.48*		
Substrate	Substrate	Reef	BRE	bre	0.88	0.54								
		Sand	SAND	san									99.60	0.40
Substrate Total					*0.88*	*0.54*							*99.60*	*0.40*
Unscorable	Unscorable	unscorable	UNS	NA	4.40	3.12			3.20	2.06	9.60	2.79		
Unscorable Total					*4.40*	*3.12*			*3.20*	*2.06*	*9.60*	*2.79*		
Grand total					*100*		*100*		*100*		*100*		*100*	

Appendix Table 2. Quantitative estimates of percentage cover at Breaksea Island T1 in 2002

		Depth (replicates)	1m (3)		2m (8)		3m (10)		5m (11)		10m (6)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	car	*Carpoglossum confluens*	0	0	2.57	2.41	3.6	2.68	14.4	6.52	0	0
	dur	*Durvillea potatorum*	81.3	9.4	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	7.71	4.7	21.8	7.4	17.5	4.78	0	0
	les	*Lessonia corrugata*	0	0	6	5.02	0	0	0	0	0	0
	mel	*Melanthalia obtusata*	0	0	0	0	10.4	6.23	4.18	3.62	0	0
	phy	*Phyllospora comosa*	3.33	3.33	44.3	13.6	0	0	1.27	1.27	0	0
	tha	*Thamnoclonium dichotomum*	0	0	0	0	1	1	1.64	1.17	0	0
Algae-red	enc	Encrusting corralines	0	0	14	5.02	30	7.63	34.7	5.08	0	0
	red	*Red rock. Peysionella spp?*	0	0	6	3.24	9	3.45	11.6	2.88	0	0
	son	*Sonderopelta coriaceae*	0	0	0	0	8	4.13	8.91	4.22	0	0
	tre	Thallose red algae	10	10	1.43	1.34	0.2	0.2	1.64	1.64	0	0
Total algae			94.7	0	82	0	84	0	95.8	0	0	0
Sponges	spo	Sponge u/i usually flat	0	0	0	0	1.6	0.93	0.91	0.62	0	0
Other cover	uid	Unidentified cover	0	0	0	0	0	0	3.82	3.82	0	0
Substrate	bre	Bare reef	0	0	18	6.51	13	5.34	0	0	0	0
	san	Sand	0	0	0	0	1.4	0.95	0	0	100	0
Total substrate			0		18		16		4.73		100	

Appendix Table 3. Quantitative estimates of percentage cover at Breaksea Island T2 in 2010

Breaksea Island T2																	
					Depth												
			Code		**0.5m**		**1m**		**2m**		**3m**		**5m**		**10m**	
Class	**Group**	**Classification**	**2010**	**2002**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Algae	Brown algae	Carpoglossum confluens	CAR	car			2.08	2.08	22.91	14.30	16.46	9.45	0.87	0.87		
		Durvillea potatorum	DUR	dur	100.00	0.00	75.42	15.48	20.55	17.91						
		Ecklonia radiata	ECK	eck					32.57	17.20	53.60	16.50	24.17	12.30		
		Lessonia corrugata	LES	les			21.67	13.33	12.99	8.08						
		Macrocystis pyrifera	MAC	mac									1.29	0.87		
	Red algae	encrusting coralline	ECO	enc					1.69	0.79	17.41	7.51	33.62	4.80	4.07	0.92
		Gelidium australe	NB51	NA					2.13	2.13						
		Geniculate coralline algae	GCO	gco									1.25	0.83	0.82	0.82
		Peyssonnelia spp.	PEY	pey					0.40	0.40	1.33	1.33	2.57	1.73		
		Phacelocarpus pepperocarpos	PHA	pha									2.17	2.17		
		Thamnoclonium dichotomum	THAM	tham									0.43	0.43		
	Unidentified algae	Unidentified algae	UNA	unka					1.30	1.30	1.41	0.98				
		Unidentified algae - erect branching	EBA	NA			0.83	0.83	0.40	0.40	2.08	1.58	5.47	2.34		
Algae Total					*100.00*		*100.00*		*94.94*		*92.28*		*71.85*		*4.89*	
Cnidarians	Soft corals	Clavularia spp. - white	CLAV	oc2											0.40	0.40
Cnidarians Total															*0.40*	
Other Cover	Other Cover	Algal turf	TURF	NA					3.82	1.99	5.57	2.67	5.45	2.24	14.65	2.38
		Biogenic Matrix	MATR	NA					1.23	0.81	2.15	1.38	6.30	2.87	19.34	10.75
Other Cover Total									*5.06*		*7.72*		*11.76*		*33.99*	
Sponges	Encrusting sponges	Encrusting sponges	-	-									0.43	0.43	0.41	0.41
Sponges Total													*0.43*		*0.41*	
Substrate	Substrate	Cobble	COB	cob									11.76	4.44	2.01	1.55
		Gravel	GRA	gra									2.08	1.32	7.72	1.35
		Reef	BRE	bre									1.70	0.81	0.41	0.41
		Sand	SAND	san									0.42	0.42	50.17	10.69
Substrate Total													*15.96*		*60.31*	
Unscorable	Unscorable	unscorable	UNS	NA	13.20	1.62	0.80	0.80	2.80	1.74	12.80	3.38	4.80	0.80	1.60	0.40
Unscorable Total					*13.20*		*0.80*		*2.80*		*12.80*		*4.80*		*1.60*	
Grand total (% scored)					*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 4. Quantitative estimates of percentage cover at Turnbull Head T1 in 2010

Turnbull Head T1															
					Depth										
					0.5m		1m		2m		5m		10m		
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	
Algae	Brown algae	Carpoglossum confluens	CAR	car			30.90	14.79	25.82	14.77					
		Durvillea potatorum	DUR	dur	76.80	19.29	8.22	6.73							
		Ecklonia radiata	ECK	eck	20.00	20.00	14.45	11.95	18.14	8.24					
		Lessonia corrugata	LES	les			1.20	1.20							
		Phyllospora comosa	PHY	phy					32.00	20.59					
	Red algae	encrusting coralline	ECO	enc			5.73	2.11	5.63	3.92					
		Foliose red algae	FORE	fore							0.41	0.41			
		Peyssonnelia spp.	PEY	pey			0.40	0.40							
		Phacelocarpus pepperocarpos	PHA	pha			26.59	12.45							
		Thamnoclonium dichotomum	THAM	tham							12.34	8.25			
	Unidentified algae	Unidentified algae	UNA	unka			4.01	2.61							
		Unidentified algae - erect branching	EBA	NA			1.23	0.81							
Algae Total					*96.80*	*39.29*	*92.72*	*53.04*	*81.59*	*47.53*	*12.75*	*8.66*			
Cnidarians	Encrusting octocora	Erythropodium hicksoni	OCT	oct							2.55	1.56			
	Gorgonian	Pteronisis plumacea	GOR	NA							0.83	0.51			
	Soft corals	Capnella spp. - brown	CAPB	socb							0.85	0.85	0.40	0.40	
		Capnella spp. - yellow	CAPY	socy									0.80	0.49	
		Clavularia spp. - white	CLAV	oc2							0.43	0.43			
	Solitary coral	Solitary coral 1	COR	sco									1.60	1.17	
Cnidarians Total											*4.65*	*3.35*	*2.80*	*2.06*	
Other Cover	Other Cover	Algal turf	TURF	NA			6.06	3.15	12.80	12.80	0.43	0.43			
		Biogenic Matrix	MATR	NA			1.23	0.50	5.61	3.19	6.29	2.60	0.40	0.40	
		Fine hydroid/bryozoan layer	BREB	breb							70.19	8.97	0.40	0.40	
Other Cover Total							*7.28*	*3.65*	*18.41*	*15.99*	*76.90*	*11.99*	*0.80*	*0.80*	
Sponges	Cup sponge	Strepsichordaia calciformis	C2S	cus2							2.87	1.04			
	Cup sponges	Cup sponges	-	-							1.21	0.80			
	Encrusting sponges	Encrusting sponges	-	-							0.82	0.82			
	Massive sponges	Massive sponges	-	-							0.41	0.41			
Sponges Total											*5.30*	*3.07*			
Substrate	Substrate	Reef	BRE	bre	3.20	2.06							0.40	0.40	
		Sand	SAND	san									96.00	1.10	
		Silt	SILT	sed							0.40	0.40			
Substrate Total					*3.20*	*2.06*					*0.40*	*0.40*	*96.40*	*1.50*	
Unscorable	Unscorable	unscorable	UNS	NA			1.60	1.17	0.40	0.40	3.60	1.47			
Unscorable Total							*1.60*	*1.17*	*0.40*	*0.40*	*3.60*	*1.47*			
Grand total (% scored)					*100*		*100*		*100*		*100*		*100*		

Appendix Table 5. Quantitative estimates of percentage cover at Turnbull Head T1 in 2002

		Depth (replicates)	0.5m (3)		1m (6)		2m (11)		5m (19)		10m (16)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	car	*Carpoglossum confluens*	0	0	55.7	6.18	62.9	8.3	0	0	0	0
	dur	*Durvillea potatorum*	90	10	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	2.67	2.67	14.9	8.7	0	0	0	0
Algae-red	enc	Encrusting corralines	5.33	5.33	38	8.1	18.4	2.75	0.11	0.11	0	0
	red	Red rock. *Peysionella* spp?	0	0	0	0	0.91	0.62	0	0	0	0
	tha	*Thamnoclonium dichotomum*	0	0	0	0	0	0	12.7	3.76	2.75	1.61
	tre	Thallose red algae	0	0	0	0	0.91	0.91	0	0	0	0
Total algae			95.3		96.3		98		12.8		2.75	
Cnidarians	soc	Soft coral	0	0	0	0	0	0	0.22	0.15	0	0
	whi	Seawhips	0	0	0	0	0	0	0.67	0.39	0	0
Total cnidarians			0		0		0		0.89		0	
Sponges	cus	Cup sponge	0	0	0	0	0	0	6	1.53	3.75	1.36
	cus2	Cup sponge. Spiral form.	0	0	0	0	0	0	1.22	0.69	1.88	1.88
	fso	Finger sponge-orange	0	0	0	0	0	0	0.33	0.24	1.25	0.87
	jhs2	Jokers hat sponge	0	0	0	0	0	0	0.22	0.22	0	0
	sp11	Large grey sponge, spines	0	0	0	0	0	0	0.22	0.22	0	0
	sp2	Sponge finger, very fine white/grey	0	0	0	0	0	0	0	0	1.25	1.25
	spo	Sponge u/i usually flat	0	0	0	0	0.36	0.36	5.33	0.42	1.13	0.41
Total sponges			0		0		0.36		13.3		9.25	
Echinoderms	gon	*Goniocidaris tubaria*	0	0	0	0	0	0	0.89	0.57	0.13	0.13
	pent	*Pentagonastar dubeni*	0	0	0	0	0	0	0.11	0.11	0	0
Other Cover	breb	Fine hydroid/bryozoan layer	0	0	0	0	0	0	69.4	3.92	67.1	6
	uid	Unidentified cover	0	0	0	0	0	0	1.56	1.51	0	0
Substrate	bre	Bare reef	4	4	3.67	3.67	1.64	1.17	69.4	3.92	67.1	6
	cob	Cobble	0	0	0	0	0	0	0	0	6.25	6.25
	san	Sand	0	0	0	0	0	0	1	0.59	14.5	4.44
Total substrate			4		3.67		1.64		70.4		87.9	

Appendix Table 6. Quantitative estimates of percentage cover at Sarah Island T1 in 2010

Sarah island T1																	
					Depth												
					0.5m		1m		2m		5m		10m		15m		20m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Carpoglossum confluens	CAR	car	2.00	2.00	18.76	8.25	31.24	6.55								
		Durvillea potatorum	DUR	dur	97.20	1.85	58.25	12.51	3.66	3.39								
		Ecklonia radiata	ECK	eck			4.51	3.86	48.21	8.10								
		Lessonia corrugata	LES	les			10.21	6.03	2.55	2.55								
		Macrocystis pyrifera	MAC	mac			0.18	0.18										
	Green algae	Chaetomorpha coliformis	NB25	NA							0.20	0.20						
	Red algae	Ballia callitrichia	BAL	bal							0.81	0.44						
		encrusting coralline	ECO	enc			6.32	2.65	11.46	3.06	8.69	2.15	0.20	0.20				
		encrusting plate coralline	EPCO	epc							0.40	0.40						
		Foliose red algae	FORE	fore					0.21	0.21	2.22	0.82						
		Melanthalia obtusata	MEL	mel					1.54	1.54	0.20	0.20						
		Peyssonnelia spp.	PEY	pey							1.63	0.74						
		Phacelocarpus pepperocarpos	PHA	pha			0.65	0.65	0.21	0.21	1.40	1.19						
		Thamnoclonium dichotomum	THAM	tham							12.80	2.31						
	Unidentified algae	Unidentified algae - drift	DRIFT	dri									2.25	1.46			1.20	0.53
		Unidentified algae - erect branching	EBA	NA			0.73	0.73										
		Unidentified algae - filamentous	FIL	NA							0.41	0.27						
Algae Total					*99.20*	*3.85*	*99.60*	*34.86*	*99.09*	*25.60*	*28.75*	*8.73*	*2.45*	*1.66*			*1.20*	*0.53*
Ascidians	Colonial ascidians	Ascidian 4 colonial – shiny white	AS5	as7													0.20	0.20
		Ascidian 5 colonial	NB33	NA													0.20	0.20
	Encrusting ascidians	Ascidian 13 encrusting	NB32	NA							0.41	0.27	1.00	1.00				
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1							0.60	0.43	0.40	0.27	3.00	0.91	3.46	0.93
		Ascidian 16 solitary - white-throat	AS3	wta									0.60	0.60	0.40	0.27		
		Ascidian unidentified	ASC	asc											0.40	0.27		
		Herdmania grandis	AS2	rta													0.60	0.43
		Pyura spp.	NB47	NA							0.20	0.20						
Ascidians Total											*1.21*	*0.90*	*2.00*	*1.87*	*3.80*	*1.44*	*4.46*	*1.75*
Bryozoans	Branching Bryozoans	Adeonellopsis parvipuncta	BRY5	br7									0.20	0.20	0.20	0.20		
		Bryozoan 12 Caberea like	BRY12	NA									0.20	0.20				
		Bryozoan 13 Caberea like 2	BRY13	NA							0.80	0.44	0.20	0.20				
		Hornea robusta	BRY3	br5									0.20	0.20			0.40	0.27
	Lace Bryozoans	Bryozoan 6 lace	BRY6	br1							0.21	0.21			0.20	0.20		
		Bryozoan 7 lace	BRY7	br2													0.40	0.40
	Soft Bryozoans	Costaticella sp	BRY1	brs							1.60	1.11	0.20	0.20			4.41	2.09
Bryozoans Total											*2.61*	*1.76*	*1.00*	*1.00*	*0.40*	*0.40*	*5.22*	*2.76*

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Appendix Table 6 *continued*. Quantitative estimates of percentage cover at Sarah Island T1 in 2010

Sarah island T1 continued…																	
					Depth												
					0.5m		**1m**		**2m**		**5m**		**10m**		**15m**		**20m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Cnidarians	Bramble corals	Acabaria sp. (orange)	ACA	brc							0.20	0.20	0.60	0.60	0.60	0.43	1.06	0.63
		Asperaxis kareni	ASP	brc2											0.20	0.20	0.41	0.27
	Encrusting octocorals	Erythropodium hicksoni	OCT	oct							3.80	2.76						
	Gorgonian	Pteronisis plumacea	GOR	NA							3.83	1.07	0.64	0.33				
	Hydroids	Hydroid 1	HYD1	hyd							0.81	0.61					0.86	0.46
		Hydroid 2 cf Nemertensia procumbens	HYD2	hyd									0.88	0.59			1.60	1.60
	Soft corals	Capnella spp. - yellow	CAPY	socy							1.41	0.60						
		Clavularia spp. - white	CLAV	oc2							0.20	0.20	0.20	0.20	0.20	0.20	0.60	0.43
	Solitary coral	Solitary coral 1	COR	sco													0.26	0.26
	Zooanthids	Parazoanthus spp.	PARA	yez									3.85	1.97				
Cnidarians Total											*10.25*	*5.44*	*6.17*	*3.68*	*1.00*	*0.83*	*4.78*	*3.65*
Echinoderm	Urchins	Goniocidaris tubaria	GON	gon							0.40	0.40	0.82	0.33	0.40	0.27	0.26	0.26
Echinoderms Total											*0.40*	*0.40*	*0.82*	*0.33*	*0.40*	*0.27*	*0.26*	*0.26*
Other Cove	Other Cover	Algal turf	TURF	NA					0.45	0.45	14.08	5.28						
		Algal/Hydroid/Silt matrix	AHS	NA							1.80	0.87						
		Biogenic Matrix	MATR	NA					0.23	0.23	4.22	1.53	0.80	0.53	2.40	1.26	2.46	0.88
		Fine hydroid/bryozoan layer	BREB	breb							24.60	8.84	63.07	6.23	18.64	4.13	58.60	3.78
		Fine sediment cover on bare reef	BRES	bres									1.20	1.00			0.20	0.20
Other Cover Total									*0.68*	*0.68*	*44.70*	*16.52*	*65.07*	*7.77*	*21.04*	*5.39*	*61.25*	*4.87*
Polychaete:	Polychaetes	Serpulid	SER	NA							0.21	0.21	0.20	0.20				
Polychaetes Total											*0.21*	*0.21*	*0.20*	*0.20*				
Sponges	Arborescent sponges	Arborescent sponges	-	-			0.22	0.22			1.21	1.00	1.27	0.92	0.20	0.20	0.83	0.64
	Cup sponge	Strepsichordaia calciformis	C2S	cus2							0.80	0.44	1.47	0.84				
	Cup sponges	Cup sponges	-	-							0.60	0.43					0.87	0.48
	Encrusting sponges	Encrusting sponges	-	-							2.21	0.63	5.49	1.47	2.40	1.97	4.20	1.21
	Globular sponges	Globular sponges	-	-							0.21	0.21						
	Lumpy sponges	Lumpy sponges	-	-							1.02	0.46	0.64	0.33			0.40	0.27
	Massive sponges	Massive sponges	-	-							0.60	0.43	0.20	0.20			0.26	0.26
	Tubular sponge	Tubular sponge	-	-									0.22	0.22				
Sponges Total							*0.22*	*0.22*			*6.64*	*3.59*	*9.29*	*3.97*	*2.60*	*2.17*	*6.56*	*2.84*
Substrate	Substrate	Gravel	GRA	gra							3.43	1.41	8.00	4.85	28.40	10.47	9.60	4.34
		Reef	BRE	bre	0.80	0.49	0.18	0.18	0.23	0.23			0.20	0.20			0.40	0.40
		Rubble	BRUB	NA							0.20	0.20			0.40	0.27	3.20	2.24
		Sand	SAND	san							1.60	1.19	4.80	2.44	41.16	13.23	2.68	1.89
		Shells	SHELL	NA											0.80	0.80	0.20	0.20
		Silt	SILT	sed													0.20	0.20
Substrate Total					*0.80*	*0.49*	*0.18*	*0.18*	*0.23*	*0.23*	*5.23*	*2.80*	*13.00*	*7.50*	*70.76*	*24.77*	*16.28*	*9.26*
Unscorable	Unscorable	unscorable	UNS	NA			5.82	1.95	6.40	2.12	0.40	0.40	1.80	1.21	0.20	0.20	2.80	2.17
Unscorable Total							*5.82*	*1.95*	*6.40*	*2.12*	*0.40*	*0.40*	*1.80*	*1.21*	*0.20*	*0.20*	*2.80*	*2.17*

Appendix Table 7. Quantitative estimates of percentage cover at Sarah Island T1 in 2002

		Depth (replicates)	1m (3)		2m (5)		5m (15)		10m (21)		15m (25)		20m (22)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	car	*Carpoglossum confluens*	0	0	76.4	11.2	0	0	0	0	0	0	0	0
	cos	*Codium spp.*	0	0	0	0	2.13	1.51	0	0	0	0	0	0
	dur	*Durvillea potatorum*	100	0	0	0	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	10.8	9.83	0	0	0	0	0	0	0	0
	xip	*Xiphophora gladiata*	0	0	14	14	0	0	0	0	0	0	0	0
Algae-red	tha	*Thamnoclonium dichotomum*	0	0	2	2	3.2	2.93	0	0	0	0	0	0
	tre	Thallose red algae	0	0	0	0	0.27	0.27	0	0	0	0	0	0
	gco	Genniculate corraline algae	0	0	0	0	0.4	0.29	0	0	0	0	0	0
Total algae			100		103		5.6		0		0		0	
Cnidarians	brc	Stoloniferous octocoral (bramble coral)	0	0	0	0	0	0	0	0	2.48	1.27	0	0
	brc2	Stoloniferous octocoral 2 (bramble coral)	0	0	0	0	0	0	0	0	0.24	0.24	0	0
	mop	Isidid sp. triangle shape	0	0	0	0	0	0	0	0	0.24	0.24	0	0
	sco	Solitary coral	0	0	0	0	0	0	0.1	0.1	0.08	0.08	0.36	0.21
	soc	Soft coral	0	0	0	0	0.4	0.4	0.6	0.4	0	0	0	0
	whi	Seawhips	0	0	0	0	0	0	0.2	0.13	0	0	0	0
	yez	Yellow zooanthid	0	0	0	0	0	0	0	0	1.52	1.1	0.45	0.36
Total cnidarians			0		0		0.4		0.9		4.56		0.82	
Sponges	cus	Cup sponge	0	0	0	0	0	0	0	0	2.24	0.77	0	0
	sp10	sponge, pink broad, branching	0	0	0	0	0	0	0	0	0.56	0.32	0	0
	sp3	Finger sponge 3, fine white/grey	0	0	0	0	0	0	0.5	0.49	4.48	1.4	0	0
	sp7	Sponge knobby	0	0	0	0	0	0	0	0	0.64	0.64	2.18	2.13
	sp8	Grey sponge, club like projections.	0	0	0	0	0	0	0	0	1.6	0.7	0	0
	sp9	Yellow vase sponge	0	0	0	0	0	0	0	0	0.16	0.16	0	0
	spo	Sponge u/i usually flat	0	0	0	0	0.93	0.47	1.2	0.41	5.36	1.02	6.18	1.54
Total sponges			0		0		1.33		1.7		15		8.36	
Bryozoans	br1	Lace bryozoan 1	0	0	0	0	0	0	0	0	0.56	0.56	0	0
	br2	Lace bryozoan 2	0	0	0	0	0	0	0	0	0.16	0.16	0	0
	br5	Branching bryozoan 1	0	0	0	0	0	0	0	0	0.32	0.22	0	0
Total bryozoans			0		0		0		0		1.04		0	
Ascidians	as1	Ascidian solitary 1	0	0	0	0	0.13	0.13	0	0	0	0	0	0
	as2	Ascidian colonial stalked.	0	0	0	0	0	0	0.2	0.13	0	0	0	0
	as3	Colonial ascidian 1	0	0	0	0	0	0	0.2	0.2	0	0	0.09	0.09
	as4	Colonial ascidian 9, blue golfball.	0	0	0	0	0	0	0	0	0.08	0.08	0	0
	wta	White throated ascidian	0	0	0	0	0	0	0.2	0.13	0	0	0	0
Echinoderms	gon	*Goniocidaris tubaria*	0	0	0	0	0.27	0.27	0	0	0.08	0.08	0.82	0.56
	tom	*Tosia magnifica*	0	0	0	0	0.4	0.4	0	0	0	0	0	0
Other Cover	breb	Fine hydroid/bryozoan layer	0	0	0	0	0	0	0	0	26.1	7.39	4.09	4
Substrate	bre	Bare reef	0	0	2.4	1.6	9.47	6.83	4.2	4.1	49.7	8.54	81.7	6
	gra	Gravel	0	0	0	0	14	9.04	0	0	0	0	0	0
	san	Sand	0	0	0	0	0	0	12.6	7.78	0	0	0	0
	sed	Sediment, usually fine	0	0	0	0	0	0	0	0	0	0	4.55	4.45
	sgr	Sand/gravel	0	0	0	0	63.2	12	80.0	10.4	0	0	0	0
Total substrate			0		2.4		86.7		96.8		49.7		86.3	

Appendix Table 8.Quantitative estimates of percentage cover at Sarah Island T2 in 2010

Sarah Island T2																					
					Depth																
			code		0.5m		1m		2m		3m		5m		10m		15m		20m		
Class	Group	Classification	2010	2002	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	
Algae	Brown algae	Carpoglossum confluens	CAR	car			28.63	11.06	15.99	3.73	0.82	0.62									
		Durvillea potatorum	DUR	dur	70.25	18.23	5.82	5.82													
		Ecklonia radiata	ECK	eck	12.00	12.00	48.62	11.63	32.08	9.37	6.83	3.07									
		Halopteris panniculata	HAL	halo					0.18	0.18											
		Macrocystis pyrifera	MAC	mac	9.30	9.30															
		Xiphophora gladiata	XIP	xip	6.45	5.96	6.32	6.32	0.37	0.37											
		Zonaria sp.	ZON	zon					1.65	1.12	0.84	0.47									
	Green algae	Chaetomorpha coliformis	NB25	NA					0.37	0.25	0.47	0.32									
		Codium pomoides	COP	cop											0.64	0.64					
		Codium spp.	COD	cos							0.20	0.20									
		Ulva spp.	ULV	uvl					0.39	0.26	0.21	0.21									
	Red algae	Ballia callitrichia	BAL	bal					1.78	1.20	0.45	0.30									
		encrusting coralline	ECO	enc			1.87	1.14	9.80	3.38	4.43	1.86									
		Foliose red algae	FORE	fore			6.56	3.67	1.51	0.74	8.29	2.16	0.21	0.21							
		Geniculate coralline algae	GCO	gco							0.20	0.20									
		Melanthalia obtusata	MEL	mel					2.33	1.49			0.66	0.45							
		Peyssonnelia spp.	PEY	pey			0.41	0.41	1.78	0.91	0.20	0.20									
		Phacelocarpus pepperocarpos	PHA	pha							1.04	0.71									
		Plocamium spp.	NB74	NA							0.65	0.46									
		Thamnoclonium dichotomum	THAM	tham					0.55	0.55	5.23	2.55	4.58	2.35							
	Unidentified algae	Unidentified algae	UNA	unka					0.36	0.36	0.22	0.22									
		Unidentified algae - drift	DRIFT	dri					0.37	0.25	0.22	0.22			0.48	0.48			0.20	0.20	
		Unidentified algae - erect branching	EBA	NA					0.56	0.40	0.41	0.41									
		Unidentified algae - filamentous	FIL	NA					0.95	0.95	0.41	0.41	0.40	0.27							
		Unidentified algae - foliose	FOL	NA					0.19	0.19	0.23	0.23					0.20	0.20			
Algae Total					*98.00*	*45.49*	*98.24*	*40.05*	*71.20*	*25.69*	*31.37*	*14.83*	*5.85*	*3.28*	*1.11*	*1.11*	*0.20*	*0.20*	*0.20*	*0.20*	
Ascidians	Colonial ascidians	Ascidian 12 colonial	NB60	NA					0.79	0.79	0.22	0.22									
		Ascidian 21 lumpy orange	NB17	NA					0.20	0.20	0.41	0.41	0.21	0.21							
		Ascidian 23 colonial orange translusce	NB73	NA							0.46	0.31									
		Ascidian 5 colonial	NB33	NA					0.18	0.18	3.50	1.38	0.21	0.21							
		Ascidian 7 colonial - white	AS7	?									1.59	1.59							
		Ascidian 8 colonial	NB55	NA											13.03	3.18					
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1									0.41	0.27	0.42	0.28	0.40	0.27			
		Herdmania grandis	AS2	rta									0.42	0.28							
		Polycarpa viridis	AS8	?							0.20	0.20			0.21	0.21	0.60	0.60			
Ascidians Total									*1.17*	*1.17*	*4.79*	*2.52*	*2.84*	*2.56*	*13.67*	*3.68*	*1.00*	*0.87*			

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Appendix Table 8 *continued*. Quantitative estimates of percentage cover at Sarah Island T2 in 2010

Sarah Island T2 *continued*																					
					Depth																
			code		**0.5m**		**1m**		**2m**		**3m**		**5m**		**10m**		**15m**		**20m**		
Class	**Group**	**Classification**	**2010**	**2002**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	
Bryozoans	Branching Bryozoans	Adeonellopsis parvipuncta	BRY5	br7											0.21	0.21					
		Bryozoan 13 Caberea like 2	BRY13	NA							1.40	0.83	0.50	0.50							
		Bryozoan 17 branching (cf Nevianipora	NB70	NA									0.25	0.25							
	Lace Bryozoans	Bryozoan 10 lace	BRY10	brb							0.22	0.22									
		Bryozoan 6 lace	BRY6	br1							0.40	0.40			0.48	0.48					
	Soft Bryozoans	Amathia wilsoni	BRY2	brs					0.81	0.46	0.20	0.20	0.44	0.29							
		Costaticella sp	BRY1	brs							0.20	0.20	1.71	0.69	0.87	0.48					
Bryozoans Total									*0.81*	*0.46*	*2.42*	*1.85*	*2.90*	*1.73*	*1.56*	*1.17*					
Cnidarians	Bramble corals	Acabaria sp. (orange)	ACA	brc									1.05	0.72	4.82	1.34					
		Asperaxis kareni	ASP	brc2									5.86	3.43							
	Encrusting octocorals	Erythropodium hicksoni	OCT	oct							4.67	1.97	2.08	1.12							
	Gorgonian	Pteronisis plumacea	GOR	NA									2.50	1.67							
	Hydroids	Hydroid 1	HYD1	hyd					0.56	0.40	1.71	1.32	0.83	0.83	1.23	0.83					
	Sea Pens	Sarcoptilus grandis	SPEN	sea											0.40	0.40					
	Soft corals	Capnella spp. - brown	CAPB	socb					0.37	0.25	5.99	1.74	1.98	0.81							
		Capnella spp. - yellow	CAPY	socy							2.46	1.04	2.05	0.69							
		Clavularia spp. - white	CLAV	oc2					0.37	0.25	3.25	1.77	12.61	3.48	1.99	1.14					
Cnidarians Total									*1.30*	*0.90*	*18.09*	*7.84*	*28.96*	*12.75*	*8.45*	*3.71*					
Echinoderms	Urchins	Goniocidaris tubaria	GON	gon									0.25	0.25							
		Heliocidaris erythrogramma	HEL	hel							0.20	0.20									
Echinoderms Total											*0.20*	*0.20*	*0.25*	*0.25*							
Other Cover	Other Cover	Algal turf	TURF	NA					20.10	5.53	16.81	2.20	0.61	0.61							
		Algal/Hydroid/Silt matrix	AHS	NA					1.48	1.48	6.12	2.40									
		Biogenic Matrix	MATR	NA					2.01	1.01	15.40	5.39	6.42	2.53	0.60	0.60					
		Bioturbation	BIOT	NA															0.20	0.20	
		Fine hydroid/bryozoan layer	BREB	breb							0.42	0.28	39.63	6.75	8.21	5.32	0.81	0.45			
Other Cover Total									*23.59*	*8.02*	*38.75*	*10.26*	*46.67*	*9.88*	*8.81*	*5.92*	*0.81*	*0.45*	*0.20*	*0.20*	
Sponges	Arborescent sponges	Arborescent sponges	-	-							0.26	0.26	0.42	0.42							
	Cup sponge	Strepsichordaia calciformis	C2S	cus2									1.17	0.76							
	Cup sponges	Cup sponges	-	-							0.20	0.20									
	Encrusting sponges	Encrusting sponges	-	-			0.21	0.21	0.18	0.18	0.20	0.20	0.61	0.43	0.45	0.30	0.20	0.20			
	Lumpy sponges	Lumpy sponges	-	-							1.93	0.59	1.01	0.80	0.87	0.58			0.20	0.20	
	Massive sponges	Massive sponges	-	-							0.20	0.20	1.64	1.14	0.23	0.23					
	Papillate sponge	Papillate sponge	-	-							0.21	0.21	1.66	1.27							
Sponges Total							*0.21*	*0.21*	*0.18*	*0.18*	*3.01*	*1.68*	*6.51*	*4.82*	*1.54*	*1.11*	*0.20*	*0.20*	*0.20*	*0.20*	
Substrate	Substrate	Gravel	GRA	gra					0.19	0.19			5.81	1.95	2.79	2.54					
		Reef	BRE	bre	2.00	2.00	1.55	0.93	1.56	0.78	1.16	1.16									
		Sand	SAND	san							0.20	0.20	0.21	0.21	62.06	7.88	97.78	1.02	99.40	0.43	
Substrate Total					*2.00*	*2.00*	*1.55*	*0.93*	*1.75*	*0.97*	*1.37*	*1.37*	*6.02*	*2.16*	*64.85*	*10.41*	*97.78*	*1.02*	*99.40*	*0.43*	
Unscorable	Unscorable	unscorable	UNS	NA	8.40	3.66	3.45	1.48	4.55	1.38	7.60	2.15	5.80	1.92	4.80	1.72	0.20	0.20			
Unscorable Total					*8.40*	*3.66*	*3.45*	*1.48*	*4.55*	*1.38*	*7.60*	*2.15*	*5.80*	*1.92*	*4.80*	*1.72*	*0.20*	*0.20*			

Appendix Table 9.Quantitative estimates of percentage cover at Sarah Island T2 in 2002

		Depth (replicates)	0m (1)		1m (4)		2m (2)		5m (20)		10m (17)		15m (22)		20m (18)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	car	*Carpoglossum confluens*	0	0	0	0	30	20	0	0	0	0	0	0	0	0
	dur	*Durvillea potatorum*	100	0	100	0	22	13	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	0	0	27	21	0	0	0	0	0	0	0	0
	les	*Lessonia corrugata*	0	0	0	0	2.5	2.5	0	0	0	0	0	0	0	0
Algae-red	enc	Encrusting corralines	0	0	0	0	16	13	11.2	2.98	0	0	0	0	0	0
	son	*Sonderopelta coriaceae*	0	0	0	0	0	0	0.3	0.22	0	0	0	0	0	0
	tha	*Thamnoclonium dichotomum*	0	0	0	0	0	0	33.3	4.79	0.47	0.36	0.36	0.36	0	0
Total algae			0		100		97		44.8		0.47		0.36		0	
Cnidarians	brc	Stoloniferous octocoral (bramble coral)	0	0	0	0	0	0	0	0	0.47	0.32	0.09	0.09	1.89	1.15
	mo1	Mopsella like -pink hydroids?	0	0	0	0	0	0	0	0	0	0	2.27	0.97	0.56	0.56
	soc	Soft coral	0	0	0	0	0	0	0.1	0.1	0	0	0.09	0.09	0	0
	whi	Seawhips	0	0	0	0	0	0	0.1	0.1	0	0	0.27	0.19	0	0
	yez	Yellow zooanthid	0	0	0	0	0	0	0	0	1.88	1.24	4.09	2.35	1.44	0.9
	hyd	Hydroids	0	0	0	0	0	0	0	0	0	0	2.09	2.04	0	0
Total cnidarians			0		0		0		0.2		2.35		8.91		3.89	
Sponges	cus	Cup sponge	0	0	0	0	0	0	2.1	1.03	0.24	0.24	3.55	1.86	5.89	1.19
	cus2	Cup sponge. Spiral form.	0	0	0	0	0	0	0.2	0.2	0.47	0.47	0	0	0	0
	fsfw	Finger sponge fine white,*Thamnoclonium*?	0	0	0	0	0	0	0	0	0	0	0.45	0.44	0	0
	fso	Finger sponge-orange	0	0	0	0	0	0	0.1	0.1	0.71	0.59	0.36	0.28	0	0
	gbs	Golfball sponge	0	0	0	0	0	0	0	0	0	0	0.09	0.09	0	0
	sp13	Finger sponge, slender white	0	0	0	0	0	0	0	0	2.94	1.54	0.09	0.09	2.11	0.71
	sp14	Vase sponge	0	0	0	0	0	0	0	0	0	0	0.09	0.09	0.11	0.11
	sp15	Volcano sponge	0	0	0	0	0	0	0	0	0	0	0.18	0.18	0	0
	sp16	Sponge small white ascidian like	0	0	0	0	0	0	0	0	0	0	0.45	0.44	0	0
	sp17	Sponge massive white-grey	0	0	0	0	0	0	0	0	0	0	0	0	0.67	0.67
	sp18	Sponge grey massive	0	0	0	0	0	0	0.5	0.41	0	0	0	0	0	0
	spo	Sponge u/i usually flat	0	0	0	0	1.6	1.6	9	1.37	8.82	4.49	6.64	1.71	7.67	1.38
	spo2	Sponge u/i usually flat	0	0	0	0	0	0	0.5	0.5	0	0	0	0	0	0
Total sponges			0		0		1.6		12.4		13.2		11.9		16.4	
Bryozoans	brf	Lace bryozoan 5	0	0	0	0	0	0	0	0	0	0	0.09	0.09	0.11	0.11
	bry	Lace bryozoan, unidentified	0	0	0	0	0	0	0.2	0.14	0	0	0	0	0	0
Total bryozoans			0		0		0		0.2		0		0.09		0.11	
Ascidians	as6	Colonial ascidian 3, scallop shape	0	0	0	0	0	0	0.2	0.2	0	0	0	0	0	0
	rta	Red-throated ascidian	0	0	0	0	0	0	0.2	0.2	0	0	0	0	0	0
	wta	White throated ascidian	0	0	0	0	0	0	0	0	0	0	0	0	0.22	0.22
Molluscs	hal	*Haliotis rubra*	0	0	0	0	0	0	0.1	0.1	0	0	0	0	0	0
Echinoderms	bas	Basketstar	0	0	0	0	0	0	0	0	0.12	0.12	0	0	0	0
	gon	*Goniocidaris tubaria*	0	0	0	0	0	0	0	0	0.47	0.21	0.27	0.15	0	0
	pet	*Petricia vernicina*	0	0	0	0	0	0	0.1	0.1	0	0	0	0	0	0
	tom	*Tosia magnifica*	0	0	0	0	0	0	0	0	0	0	0	0	0.11	0.11
Other Cover	epi	Fine hydroid/bryozoan layer	0	0	0	0	0	0	41.8	3.77	47.3	11.2	48.4	7.15	61.6	7.34
Substrate	bre	Bare reef	0	0	0	0	1.6	1.6	41.8	3.77	81.1	6.03	58.5	6.17	75.9	3.42
	san	Sand	0	0	0	0	0	0	0	0	6.12	4.72	7	3.19	3.22	1.28
	sed	Sediment, usually fine	0	0	0	0	0	0	0	0	4.94	4.94	0	0	0	0
	sgr	Sand/gravel	0	0	0	0	0	0	0	0	5.18	5.18	13	6.99	0	0
Total substrate			0		0		1.6		41.8		97.3		78.5		79.1	

Appendix Table 10.Quantitative estimates of percentage cover at Sarah Island T3 in 2010

Sarah Island T3																			
					Depth														
					0.5m		1m		2m		3m		5m		10m		15m		20m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Carpoglossum confluens	CAR	car			37.40	7.77	11.97	6.18	4.43	1.76								
		Dictyopteris muelleri	NB22	NA							0.23	0.23								
		Durvillea potatorum	DUR	dur	25.60	14.19														
		Ecklonia radiata	ECK	eck			6.74	5.95	64.46	8.39	5.40	5.40								
		Halopteris panniculata	HAL	halo			0.91	0.91												
		Macrocystis pyrifera	MAC	mac	58.80	20.73	19.41	6.96												
		Sargassum sp.	SAR	Sar			6.60	3.20												
		Xiphophora gladiata	XIP	xip	6.00	6.00														
		Zonaria sp.	ZON	zon			0.93	0.58			4.75	1.80								
	Green algae	Caulerpa spp.	CAL	caul					0.20	0.20			0.20	0.20						
		Chaetomorpha coliformis	NB25	NA			0.58	0.58			0.62	0.44								
		Codium spp.	COD	cos									0.20	0.20	0.41	0.27				
	Red algae	encrusting coralline	ECO	enc			3.95	1.67	14.89	3.57	22.11	3.74	2.64	0.80						
		encrusting plate coralline	EPCO	epc							0.20	0.20	0.20	0.20						
		Foliose red algae	FORE	fore			0.19	0.19			0.20	0.20	0.60	0.31	0.20	0.20				
		Peyssonnelia spp.	PEY	pey			0.37	0.25	0.65	0.48	6.48	1.82	0.40	0.27						
		Plocamium spp.	NB74	NA			1.10	0.74												
		Thamnoclonium dichotomum	THAM	tham							29.95	5.77	18.79	4.76	0.20	0.20				
	Unidentified algae	Unidentified algae	UNA	unka			1.30	0.88			0.42	0.42								
		Unidentified algae - drift	DRIFT	dri							0.83	0.64	0.20	0.20	2.02	0.85	0.95	0.52	0.60	0.60
		Unidentified algae - erect branching	EBA	NA			0.93	0.75			0.20	0.20								
		Unidentified algae - filamentous	FIL	NA			0.38	0.25			0.21	0.21								
		Unidentified algae - foliose	FOL	NA			1.11	0.93			1.03	0.55	0.20	0.20						
Algae Total					*90.40*	*40.92*	*81.91*	*31.60*	*92.17*	*18.82*	*77.08*	*23.39*	*23.45*	*7.15*	*2.83*	*1.52*	*0.95*	*0.52*	*0.60*	*0.60*
Ascidians	Colonial ascidians	Ascidian 20 lumpy yellow	NB16	NA															0.43	0.43
		Ascidian 5 colonial	NB33	NA					0.23	0.23					0.20	0.20				
		Ascidian 9 colonial – blue golfball	AS6	as4											0.20	0.20				
	Encrusting ascidians	Ascidian 13 encrusting	NB32	NA															0.20	0.20
		Ascidian 14 encrusting	NB62	NA									1.60	1.22	0.20	0.20				
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1											4.27	1.33	1.12	0.42	1.25	0.45
		Ascidian 16 solitary - white-throat	AS3	wta											0.62	0.44			0.21	0.21
		Ascidian unidentified	ASC	asc									0.20	0.20	0.20	0.20	0.19	0.19		
		Sycozoa pulchra	NB7	NA											0.40	0.27				
Ascidians Total									*0.23*	*0.23*			*1.80*	*1.42*	*6.10*	*2.84*	*1.32*	*0.62*	*2.09*	*1.29*
Bivalves	Abalone	Haliotus rubra	AB	hal					0.20	0.20										
Bivalves Total									*0.20*	*0.20*										
Bryozoans	Branching Bryozoans	Adeonellopsis parvipuncta	BRY5	br7											0.82	0.46	0.37	0.25	0.20	0.20
		Bryozoan 13 Caberea like 2	BRY13	NA							0.20	0.20	0.40	0.27						
	Lace Bryozoans	Bryozoan 10 lace	BRY10	brb							0.20	0.20								
	Plate Bryozoans	Bryozoan 16 plate	NB6	NA											0.20	0.20				
	Soft Bryozoans	Amathia wilsoni	BRY2	brs							2.36	1.53								
		Costaticella sp	BRY1	brs													0.57	0.41	1.31	0.77
Bryozoans Total											*2.77*	*1.93*	*0.40*	*0.27*	*1.02*	*0.66*	*0.94*	*0.66*	*1.51*	*0.97*

Appendix Table 10 *continued*. Quantitative estimates of percentage cover at Sarah Island T3 in 2010

Sarah Island T3 *continued*																			
					Depth														
					0.5m		**1m**		**2m**		**3m**		**5m**		**10m**		**15m**		**20m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Cnidarians	Bramble corals	Acabaria sp. (orange)	ACA	brc															0.22	0.22
	Encrusting octocorals	Erythropodium hicksoni	OCT	oct									0.81	0.62						
	Gorgonian	Pteronisis plumacea	GOR	NA									4.69	1.62						
	Hydroids	Hydroid 1	HYD1	hyd			0.39	0.39			1.03	0.71					0.18	0.18	0.20	0.20
		Hydroid 2 cf Nemertensia procumbens	HYD2	hyd															1.20	1.20
	Soft corals	Capnella spp. - yellow	CAPY	socy											0.81	0.45				
		Clavularia spp. - white	CLAV	oc2							0.20	0.20	0.20	0.20	2.21	1.38	3.81	1.55	0.22	0.22
	Solitary coral	Solitary coral 1	COR	sco					0.40	0.40					0.20	0.20	0.19	0.19	0.21	0.21
	Zooanthids	Parazoanthus spp.	PARA	yez													0.57	0.57	1.21	0.69
Cnidarians Total							*0.39*	*0.39*	*0.40*	*0.40*	*1.24*	*0.91*	*5.70*	*2.44*	*3.22*	*2.03*	*4.75*	*2.49*	*3.27*	*2.75*
Echinoder	Sea Stars	Tosia magnifica	TOM	tom													0.39	0.39		
	Urchins	Goniocidaris tubaria	GON	gon							0.20	0.20	0.61	0.61	0.40	0.40	0.19	0.19	0.41	0.28
Echinoderms Total											*0.20*	*0.20*	*0.61*	*0.61*	*0.40*	*0.40*	*0.58*	*0.58*	*0.41*	*0.28*
Fish	Fish	Fish unidentified	FISH	NA											0.20	0.20				
Fish Total															*0.20*	*0.20*				
Other Cov	Other Cover	Algal turf	TURF	NA			10.17	4.38	1.40	1.40	6.19	2.54	2.01	1.23	1.21	0.68				
		Algal/Hydroid/Silt matrix	AHS	NA			4.33	3.07			7.99	4.13	21.12	8.60	10.50	3.72	0.38	0.25	1.32	1.11
		Biogenic Matrix	MATR	NA			1.13	0.95			1.88	1.12	2.44	1.40	1.60	0.98	5.27	2.31	2.05	0.97
		Fine hydroid/bryozoan layer	BREB	breb									31.08	10.47	4.40	2.81	56.93	3.78	70.74	2.99
		Fine sediment cover on bare reef	BRES	bres											0.20	0.20	0.38	0.38		
Other Cover Total							*15.63*	*8.40*	*1.40*	*1.40*	*16.06*	*7.80*	*56.64*	*21.70*	*17.91*	*8.39*	*62.95*	*6.72*	*74.10*	*5.06*
Polychaet	Polychaetes	Serpulid	SER	NA													0.20	0.20		
Polychaetes Total																	*0.20*	*0.20*		
Sponges	Arborescent sponges	Arborescent sponges	-	-									0.20	0.20			0.80	0.62	1.03	0.55
	Cup sponge	Strepsichordaia calciformis	C2S	cus2									0.20	0.20			2.95	1.66	1.02	1.02
	Cup sponges	Cup sponges	-	-													2.07	0.92	4.75	1.71
	Encrusting sponges	Encrusting sponges	-	-			0.39	0.39	0.80	0.80			0.43	0.43	2.01	0.73	2.21	0.91	1.63	1.03
	Globular sponges	Globular sponges	-	-											0.20	0.20				
	Lumpy sponges	Lumpy sponges	-	-							0.21	0.21	0.20	0.20	0.20	0.20	4.23	1.85	2.30	0.93
	Massive sponges	Massive sponges	-	-							0.41	0.41	0.20	0.20	0.41	0.27	0.56	0.56	0.67	0.67
	Tubular sponge	Tubular sponge	-	-							0.40	0.27	0.80	0.80			0.19	0.19	0.41	0.41
Sponges Total							*0.39*	*0.39*	*0.80*	*0.80*	*1.02*	*0.89*	*2.03*	*2.03*	*2.82*	*1.40*	*13.01*	*6.71*	*11.80*	*6.33*
Substrate	Substrate	Cobble	COB	cob											0.60	0.43				
		Gravel	GRA	gra					0.85	0.57					6.87	2.74	4.32	3.35		
		Reef	BRE	bre	9.60	5.27	1.69	0.60	3.72	1.27	1.44	0.69	0.20	0.20	0.60	0.31			0.20	0.20
		Rubble	BRUB	NA									0.43	0.43			0.38	0.25	3.37	2.73
		Sand	SAND	san					0.23	0.23			8.73	3.92	56.83	7.05	9.64	3.45	2.04	0.80
		Shells	SHELL	NA											0.60	0.31			0.61	0.43
		Silt	SILT	sed							0.20	0.20					0.98	0.61		
Substrate Total					*9.60*	*5.27*	*1.69*	*0.60*	*4.80*	*2.07*	*1.64*	*0.89*	*9.36*	*4.55*	*65.50*	*10.83*	*15.32*	*7.66*	*6.22*	*4.17*
Unscorabl	Unscorable	unscorable	UNS	NA			2.91	1.06	1.80	1.28	3.40	1.30	1.60	0.65	0.60	0.43	3.64	1.07	4.40	1.48
Unscorable Total							*2.91*	*1.06*	*1.80*	*1.28*	*3.40*	*1.30*	*1.60*	*0.65*	*0.60*	*0.43*	*3.64*	*1.07*	*4.40*	*1.48*
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 11.Quantitative estimates of percentage cover at Sarah Island T3 in 2002

		Depth (replicates)	0.5m (5)		1m (7)		2m (8)		3m (15)		5m (20)		10m (20)		15m (21)		20m (10)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	bro	Brown algae unidentified	0	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0
	car	Carpoglossum confluens	0	0	32	12.2	39.5	12.4	24.3	9.6	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	26.3	12.9	21.5	9.4	1.47	1.47	0	0	0	0	0	0	0	0
	mac	*Macrocystis pyrifera*	0	0	23.4	15.6	0	0	0	0	0	0	0	0	0	0	0	0
	xip	*Xiphophora gladiata*	74.4	12.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Algae-green	ulv	*Ulva* spp.	10.8	6.97	0	0	0.75	0.75	0	0	0	0	0	0	0	0	0	0
Algae-red	enc	Encrusting corralines	0	0	8.29	4.1	8.25	2.79	5.73	2.47	5.5	1.53	0	0	0	0	0	0
	tha	Thamnoclonium dichotomum	0	0	0	0	0	0	9.87	3.9	14.7	3.77	0.1	0.1	0	0	0	0
Total algae			85.2		90		74		41.3		20.2		0.1		0		0	
Cnidarians	brc	Stoloniferous octocoral (bramble coral)	0	0	0	0	0	0	0	0	0	0	0	0	3	1.39	0	0
	sco	Solitary coral	0	0	0	0	0	0	0.13	0.13	0	0	0	0	0	0	0.6	0.97
	sea	Seapen	0	0	0	0	0	0	0	0	0	0	5.3	1.03	0	0	0	0
	soc	Soft coral	0	0	0	0	0	0	1.33	0.99	0.3	0.22	0	0	0	0	0	0
	whi	Seawhips	0	0	0	0	0	0	0	0	0.3	0.3	0	0	0	0	0	0
	yez	Yellow zooanthid	0	0	0	0	0	0	0	0	0	0	0	0	1.3	0.75	0.4	1.26
Total cnidarians			0		0		0		1.47		0.6		5.3		4.3		1	
Sponges	cus	Cup sponge	0	0	0	0	0	0	0	0	2.3	0.94	0	0	1.2	0.66	1.6	3.24
	cus2	Cup sponge. Spiral form.	0	0	0	0	0	0	0	0	1.2	1.2	0	0	0	0	0	0
	fso	Finger sponge-orange	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0.29	0	0
	sp18	Sponge grey massive	0	0	0	0	0	0	0	0	0.3	0.22	0	0	0	0	0	0
	sp21	Sponge pink-orange knobby	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	1.26
	sp7	Sponge knobby	0	0	0	0	0	0	0	0	0.2	0.2	0	0	0	0	0	0
	sp9	Yellow vase sponge	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.2	0.63
	spo	Sponge u/i usually flat	0	0	0	0	0.75	0.53	10.9	2.62	7.4	1.29	0	0	7.8	3.83	1.2	1.69
Total sponges			0		0		0.75		10.9		11.4		0		9.4		3.4	
Bryozoans	br2	Lace bryozoan 2	0	0	0	0	0	0	0	0	0	0	0.6	0.6	2.6	0.96	0.4	1.26
	br5	Branching bryozoan 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	1.4
	br6	Branching bryozoan 2	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0.27	0	0
	brs	Bryozoan soft.	0	0	0	0	0.75	0.75	0.13	0.13	0	0	0	0	0	0	0	0
	bry	Lace bryozoan, unidentified	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0	0	0
Total bryozoans			0		0		0.75		0.13		0		0.7		3		1.2	
Ascidians	asc	Ascidian u/I	0	0	0	0	0	0	0	0	0.5	0.5	0	0	0	0	0	0
	rta	Red-throated ascidian	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
	wta	White throated ascidian	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.63
Echinoderms	gon	*Goniocidaris tubaria*	0	0	0	0	0	0	0	0	0.2	0.2	0	0	0.9	0.46	0.4	1.26
	tom	*Tosia magnifica*	0	0	0	0	0	0	0	0	0.4	0.31	0	0	0.1	0.1	0	0
Cover	epi	Fine hydroid/bryozoan layer	0	0	0	0	0	0	0	0	59.5	5.23	0	0	30.8	6.76	37.2	36.6
	uic	Unidentified cover	0	0	0	0	0	0	26.8	8.32	0	0	0	0	0	0	0	0
Substrate	bre	Bare reef	14.8	7.53	10	3.49	20	6.16	19.2	7.73	63.1	4.21	0	0	37.2	6.69	44.8	37.7
	san	Sand	0	0	0	0	0	0	0	0	3.5	1.29	0	0	0	0	0	0
	sed	Sediment, usually fine	0	0	0	0	0	0	0	0	0.2	0.2	92.9	1.49	45	7.66	49	44.8
Total substrate			14.8		10		20		19.2		66.8		92.9		82.2		93.8	

Appendix Table 12.Quantitative estimates of percentage cover at Waterfall Bay T1 in 2010

Waterfall Bay T1																			
					Depth														
					0.5m		1m		2m		3m		5m		6.5m		7.5m		
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	
Algae	Brown algae	Carpoglossun	CAR	car	4.86	4.86	56.81	19.72											
		Ecklonia radi	ECK	eck	6.01	4.28	28.23	18.35	99.20	0.80									
		Hormisira bar	HOR	hor	7.27	4.10													
		Macrocystis p	MAC	mac	31.58	20.45													
		Sargassum sp	SAR	Sar	19.01	6.67	9.91	7.66											
		Xiphophora g	XIP	xip	17.56	7.02													
	Green algae	Algal Mat Gre	AMG	NA									8.71	5.66			0.41	0.41	
	Red algae	Peyssonnelia	PEY	pey			2.33	2.33											
	Unidentified algae	Unidentified	UNA	unka	0.53	0.53	0.47	0.47											
		Unidentified	DRIFT	dri									0.41	0.41					
		Unidentified	EBA	NA									0.91	0.91					
Algae Total					*86.83*	*47.92*	*97.74*	*48.51*	*99.20*	*0.80*			*10.03*	*6.98*			*0.41*	*0.41*	
Bryozoans	Branching Bryozoa	Bryozoan 14 l	NB11	NA							8.89	1.39							
	Lace Bryozoans	Bryozoan 6 la	BRY6	br1							0.40	0.40							
Bryozoans Total											*9.29*	*1.79*							
Cnidarians	Sea Pens	Sarcoptilus gr	SPEN	sea													0.80	0.80	
	Soft corals	Capnella spp.	CAPB	socb							6.04	2.47							
		Capnella spp.	CAPY	socy							2.42	0.75	3.73	1.17					
Cnidarians Total											*8.46*	*3.21*	*3.73*	*1.17*			*0.80*	*0.80*	
Echinoderms	Sea Stars	Tosia magnifi	TOM	tom											0.42	0.42			
Echinoderms Total															*0.42*	*0.42*			
Other Cover	Other Cover	Algal turf	TURF	NA	1.95	1.95	2.26	1.80	0.80	0.80									
		Biogenic Mat	MATR	NA							7.70	3.20	8.30	6.73					
		Bioturbation	BIOT	NA											0.80	0.49	0.81	0.49	
		Fine hydroid/	BREB	breb							70.10	5.85							
Other Cover Total					*1.95*	*1.95*	*2.26*	*1.80*	*0.80*	*0.80*	*77.80*	*9.05*	*8.30*	*6.73*	*0.80*	*0.49*	*0.81*	*0.49*	
Polychaetes	Polychaetes	Galeolaria sp	GAL	gal	1.46	1.46													
Polychaetes Total					*1.46*	*1.46*													
Sponges	Encrusting sponge	Encrusting sp	-	-							3.65	1.36							
	Lumpy sponges	Lumpy spong	-	-							0.41	0.41	0.41	0.41					
	Massive sponges	Massive spon	-	-							0.40	0.40							
Sponges Total											*4.46*	*2.16*	*0.41*	*0.41*					
Substrate	Substrate	Gravel	GRA	gra									0.82	0.82					
		Reef	BRE	bre	9.75	4.62													
		Sand	SAND	san									76.30	8.73	98.78	0.50	97.98	0.90	
		Shells	SHELL	NA									0.41	0.41					
Substrate Total					*9.75*	*4.62*							*77.53*	*9.96*	*98.78*	*0.50*	*97.98*	*0.90*	
Unscorable	Unscorable	unscorable	UNS	NA	24.00	2.00	5.60	3.43			0.80	0.49	3.60	2.14	0.80	0.80	0.40	0.40	
Unscorable Total					*24.00*	*2.00*	*5.60*	*3.43*			*0.80*	*0.49*	*3.60*	*2.14*	*0.80*	*0.80*	*0.40*	*0.40*	
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		

Appendix Table 13.Quantitative estimates of percentage cover at Waterfall Bay T1 in 2002

		Depth (replicates)	1m (1)		2m (4)		5m (20)		5m reef (21)		6m (7)		7m (20)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	alg	*Unidentified algae*	18	0	0	0	0	0	0	0	0	0	0	0
Algae-brown	car	*Carpoglossum confluens*	0	0	21	8.1	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	6.5	4.27	0	0	0	0	0	0	0	0
	mac	*Macrocystis pyrifera*	2	0	5	5	0	0	0	0	0	0	0	0
	tbr	Turfing brown algae	0	0	22.5	16.5	0	0	0	0	0	0	0	0
	xip	*Xiphophora gladiata*	48	0	3	3	0	0	0	0	0	0	0	0
Algae-green	csoc	*Codium* spp.	0	0	0	0	0	0	0.2	0.2	0	0	0	0
	ulv	*Ulva* spp.	32	0	0	0	0	0	0	0	0	0	0	0
Algae-red	enc	Encrusting corralines	0	0	0	0	0	0	4.4	2.12	0	0	0	0
	tha	*Thamnoclonium dichotomum*	0	0	0	0	1	0.75	10.2	3.31	0	0	0	0
Total algae			100		58		1		14.8		0		0	
Cnidarians	oct	Common octocoral	0	0	0	0	0	0	2	1.39	0	0	0	0
	sea	Seapen	0	0	0	0	0	0	0	0	0	0	0	0
	soc	Soft coral	0	0	0	0	7.1	1.49	4.9	2.23	2.86	1.94	0	0
Total cnidarians			0		0		7.1		6.9		2.86		0	
Sponges	cus	Cup sponge	0	0	0	0	1.1	0.73	0	0	0	0	0	0
	fsfw	Finger sponge fine white,*Tham?*	0	0	0	0	0	0	0.4	0.27	0	0	0	0
	spo	Sponge u/i usually flat	0	0	2	2	0.7	0.26	8.5	1.93	0	0	0	0
Total sponges			0		2		1.8		8.9		0		0	
Bryozoans	br5	Branching bryozoan 1	0	0	0	0	0	0	0.2	0.2	0	0	0	0
	brf	Lace bryozoan 5	0	0	0	0	0	0	0.5	0.49	0	0	0	0
	bry	Lace bryozoan, unidentified	0	0	0	0	0	0	0.3	0.21	0	0	0	0
Total bryozoans			0		0		0		1		0		0	
Ascidians	as10	Ascidian colonial stalked	0	0	0	0	0	0	0	0	0	0	0.1	0.1
	as7	Colonial ascidian 4 shiny white	0	0	0	0	0.2	0.2	0	0	0	0	0	0
	as8	Colonial ascidian 5	0	0	0	0	0	0	0.3	0.29	0	0	0	0
	as9	Colonial ascidian 6	0	0	0	0	0	0	0.1	0.1	0	0	0	0
	asc	Ascidian u/I	0	0	0	0	0.1	0.1	0	0	0	0	0	0
	rta	Red-throated ascidian	0	0	0	0	0.7	0.42	0	0	0	0	0	0
Echinoderms	ber	Basketstar	0	0	0	0	0	0	3.6	3.51	0	0	0	0
	tom	*Tosia magnifica*	0	0	0	0	0	0	0	0	0	0	0.2	0.2
Other Cover	breb	Fine hydroid/bryozoan layer	0	0	40	15.4	0	0	71.9	5.63	0	0	0	0
Substrate	bre	Bare reef	0	0	40	15.4	19.2	8.82	68.3	6.63	0	0	0	0
	san	Sand	0	0	0	0	28.4	12.3	1.5	1.46	0	0	0	0
	sed	Sediment, usually fine	0	0	0	0	4.4	4.4	0	0	97.1	1.94	99.9	0.1
	sgr	Sand/gravel	0	0	0	0	21.7	8.67	0	0	0	0	0	0
	ssh	Sand with shells	0	0	0	0	20.4	8.11	0	0	0	0	0	0
Total cover			0		40		94.1		69.8		97.1		99.9	

Appendix Table 14.Quantitative estimates of percentage cover at Waterfall Bay T2 in 2010

Waterfall Bay T2																					
					Depth																
					0.5m		1m		2m		3m		5m		5.6m		6.0m		6.1m		10.5m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Carpoglossum confluens	CAR	car	0.40	0.40	8.00	3.16	16.86	9.89												
		Caulocystis sp.	CAU	cau	7.20	5.43																
		Ecklonia radiata	ECK	eck			91.60	3.43	77.46	9.66												
		Hormisira banksii	HOR	hor	0.40	0.40																
		Macrocystis pyrifera	MAC	mac	34.40	13.00																
		Sargassum sp.	SAR	Sar	24.00	12.47																
		Xiphophora gladiata	XIP	xip	16.80	6.02																
		Zonaria sp.	ZON	zon					0.41	0.41	3.62	2.71										
	Green algae	Algal Mat Green	AMG	NA	0.40	0.40							3.22	0.82					0.80	0.80		
		Codium spp.	COD	cos	1.60	1.17																
	Red algae	encrusting coralline	ECO	enc					0.82	0.82												
		Geniculate coralline algae	GCO	gco					0.41	0.41	1.63	1.63										
		Phacelocarpus pepperocarpos	PHA	pha							29.67	9.69										
	Unidentified algae	Unidentified algae	UNA	unka					0.40	0.40	1.60	0.75										
		Unidentified algae - drift	DRIFT	dri							7.66	4.47										
		Unidentified algae - erect branch	EBA	NA	0.40	0.40					2.45	2.45										
		Unidentified algae - filamentous	FIL	NA					2.44	1.98												
Algae Total					*85.60*	*39.68*	*99.60*	*6.59*	*98.79*	*23.56*	*46.63*	*21.70*	*3.22*	*0.82*					*0.80*	*0.80*		
Cnidarians	Sea Pens	Sarcoptilus grandis	SPEN	sea									2.40	2.40			2.40	2.40	1.20	0.80		
	Soft corals	Capnella spp. - yellow	CAPY	socy									3.60	2.71					1.60	1.60		
Cnidarians Total													*6.00*	*5.11*			*2.40*	*2.40*	*2.80*	*2.40*		
Other Cover	Other Cover	Biogenic Matrix	MATR	NA							8.11	2.67										
		Bioturbation	BIOT	NA							0.40	0.40	2.00	2.00	4.00	2.10	0.80	0.80	1.60	1.17		
Other Cover Total											*8.51*	*3.07*	*2.00*	*2.00*	*4.00*	*2.10*	*0.80*	*0.80*	*1.60*	*1.17*		
Substrate	Substrate	Reef	BRE	bre	14.40	3.87	0.40	0.40	1.21	0.49												
		Sand	SAND	san							44.87	12.40	88.78	5.12	96.00	2.10	96.80	2.33	94.80	2.06	99.20	0.49
		Shells	SHELL	NA																	0.40	0.40
		Silt	SILT	sed																	0.40	0.40
Substrate Total					*14.40*	*3.87*	*0.40*	*0.40*	*1.21*	*0.49*	*44.87*	*12.40*	*88.78*	*5.12*	*96.00*	*2.10*	*96.80*	*2.33*	*94.80*	*2.06*	*100.00*	*1.29*
Unscorable	Unscorable	unscorable	UNS	NA					0.40	0.40	0.80	0.49	0.40	0.40								
Unscorable Total									*0.40*	*0.40*	*0.80*	*0.49*	*0.40*	*0.40*								
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 15.Quantitative estimates of percentage cover at Waterfall Bay T2 in 2002

		Depth (replicates)	0m (5)		0.5m (5)		1m (6)		2m (15)		5m (26)		7m (25	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	bro	Brown algae unidentified	2	2	0	0	0	0	0	0	0	0	0	0
1	car	*Carpoglossum confluens*	0	0	52.8	8.4	27	16.3	21.6	7.46	0	0	0	0
1	cau	*Caulocystis* sp.	0	0	6.4	5.04	0	0	0	0	0	0	0	0
1	eck	*Ecklonia radiata*	0	0	0	0	19.7	10.4	34.8	9.16	0	0	0	0
1	fbr	Fillamentous browns	0	0	1.2	1.2	0	0	0	0	0	0	0	0
1	halo	*Halopteris panniculata*	0	0	0	0	0	0	5.74	5.74	0	0	0	0
1	hor	*Hormisira banksii*	20.4	13	0	0	0	0	0	0	0	0	0	0
1	mac	*Macrocystis pyrifera*	0	0	1.2	1.2	17.3	16.5	0.26	0.26	0	0	0	0
1	scy	*Scytosiphon lomentaria*	2.8	2.8	0	0	0	0	0	0	0	0	0	0
1	xip	*Xiphophora gladiata*	0	0	27.6	11.5	3	3	0	0	0	0	0	0
Algae-green	cop	*Codium pomoides*	0	0	0	0	0	0	0.66	0.66	0	0	0	0
2	ulv	*Ulva* spp.	29.2	10.2	1.6	1.6	0	0	0	0	0	0	0	0
Algae-red	bal	*Ballia callitrichia*	0	0	0	0	0	0	1.34	1.34	0	0	0	0
3	enc	Encrusting corralines	1.6	1.6	0	0	0	0	4.94	1.72	0	0	0	0
3	rho	*Rhodymenia* spp.	0	0	0	0	0	0	0.66	0.66	0	0	0	0
3	tre	Thallose red algae	0	0	0	0	0	0	1.2	1.2	0	0	0	0
Total algae			56		90.8		67		71.2		0		0	
Cnidarians	sea	Seapen	0	0	0	0	0	0	0	0	0.84	0.44	0.72	0.42
	soc	Soft coral	0	0	0	0	0	0	0	0	2.62	1.78	0	0
Total cnidarians			0		0		0		0		3.46		0.72	
Sponges	spo	Sponge u/i usually flat	0	0	0	0	0	0	0	0	0.08	0.08	0	0
Ascidians	yta	Yellow-throated ascidian	0	0	0	0	0	0	0	0	0.16	0.16	0	0
Substrate	sed	Sediment, usually fine	0	0	0	0	0	0	0	0	96.4	1.78	99.2	0.42
	bre	Bare reef	44	15.1	9.2	3.82	33	13	22.2	4.98	0	0	0	0
Total substrate			44		9.2		33		22.2		96.4		99.2	

Appendix Table 16.Quantitative estimates of percentage cover at Waterfall Bay T2 extension in 2002

		Depth (replicates)	7m (13)		8m (7)		9m (8)		10m (6)		11m (6)		12m (6)		13m (7)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Cnidarians	sea	Seapens	0.77	0.48	2	1.15	1.75	0.8	1	0.68	0	0	0.67	0.67	0	0
Substrate	sed	Sediment	99.2	0.48	98	1.15	98.3	0.8	99	0.68	100	0	99.3	0.67	100	0

Appendix Table 17.Quantitative estimates of percentage cover at Waterfall Bay T3 in 2010

Waterfall Bay T3																	
					Depth												
					0.5m		1m		2m		3m		7.5m		8m		
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	
Algae	Brown algae	Carpoglossum confluens	CAR	car	10.36	4.57	11.60	7.17	8.17	7.66							
		Durvillea potatorum	DUR	dur	3.11	3.11			5.82	5.33							
		Ecklonia radiata	ECK	eck	18.75	9.81	86.00	6.96	80.60	11.67							
		Macrocystis pyrifera	MAC	mac	38.85	17.25											
		Sargassum sp.	SAR	Sar	1.36	0.88											
		Xiphophora gladiata	XIP	xip	23.79	16.06											
	Green algae	Algal Mat Green	AMG	NA							0.40	0.40					
	Red algae	encrusting coralline	ECO	enc					0.42	0.42							
		Peyssonnelia spp.	PEY	pey	0.45	0.45	0.40	0.40	0.83	0.83							
		Thamnoclonium dichotomum	THAM	tham							1.60	1.60					
	Unidentified algae	Unidentified algae	UNA	unka	1.96	1.49											
		Unidentified algae - drift	DRIFT	dri					0.41	0.41	0.40	0.40					
Algae Total					*98.64*	*53.62*	*98.00*	*14.52*	*96.25*	*26.32*	*2.40*	*2.40*					
Cnidarians	Sea Pens	Sarcoptilus grandis	SPEN	sea									0.80	0.80			
	Sea Whips	?Primnoella australasiae	SW	whi							0.40	0.40					
	Soft corals	Capnella spp. - brown	CAPB	socb							2.80	2.33					
		Capnella spp. - yellow	CAPY	socy							8.80	2.80					
Cnidarians Total											*12.00*	*5.53*	*0.80*	*0.80*			
Other Cover	Other Cover	Algal turf	TURF	NA			0.40	0.40									
		Biogenic Matrix	MATR	NA			1.60	1.60	3.75	3.75	0.40	0.40					
Other Cover Total							*2.00*	*2.00*	*3.75*	*3.75*	*0.40*	*0.40*					
Sponges	Cup sponge	Strepsichordaia calciformis	C2S	cus2							1.20	0.80					
	Encrusting sponge	Encrusting sponges	-	-							0.80	0.80					
	Lumpy sponges	Lumpy sponges	-	-							0.40	0.40					
Sponges Total											*2.40*	*2.00*					
Substrate	Substrate	Reef	BRE	bre	1.36	1.36											
		Rubble	BRUB	NA							0.40	0.40					
		Sand	SAND	san							82.40	4.40	99.20	0.80	100.00		
Substrate Total					*1.36*	*1.36*					*82.80*	*4.80*	*99.20*	*0.80*	*100.00*		
Unscorable	Unscorable	unscorable	UNS	NA	11.20	2.94			1.20	0.80							
Unscorable Total					*11.20*	*2.94*			*1.20*	*0.80*							
Grand total (% scored)					*100*		*100*		*100*		*100*		*100*		*100*		

Appendix Table 18.Quantitative estimates of percentage cover at Beabey Point T1 in 2010

Beabey Point T1																			
					Depth														
					0.5m		1m		2m		3m		5m		10m		15m		
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	
Algae	Brown algae	Carpoglossum confluens	CAR	car	73.13	11.29	35.35	18.76	0.40	0.40									
		Ecklonia radiata	ECK	eck	2.82	1.75	63.83	18.98	98.80	1.20	11.29	10.28							
		Macrocystis pyrifera	MAC	mac	12.80	8.71													
		Sargassum sp.	SAR	Sar	6.02	2.96													
		Zonaria sp.	ZON	zon							4.48	2.76							
	Green algae	Algal Mat Green	AMG	NA							0.42	0.42	17.22	4.79					
	Red algae	Peyssonnelia spp.	PEY	pey							0.83	0.51							
		Phacelocarpus pepperocarpos	PHA	pha							0.40	0.40							
		Thamnoclonium dichotomum	THAM	tham							5.72	3.79	2.80	2.80					
	Unidentified algae	Unidentified algae	UNA	unka	5.22	2.33	0.82	0.50											
		Unidentified algae - drift	DRIFT	dri							0.40	0.40					0.40	0.40	
		Unidentified algae - erect branching	EBA	NA							3.75	3.75							
Algae Total					*100.00*	*27.05*	*100.00*	*38.24*	*99.20*	*1.60*	*27.30*	*22.31*	*20.02*	*7.59*			*0.40*	*0.40*	
Ascidians	Solitary ascidians	Ascidian unidentified	ASC	asc									0.40	0.40			0.40	0.40	
Ascidians Total													*0.40*	*0.40*			*0.40*	*0.40*	
Bryozoans	Branching Bryozoa	Bryozoan 4 branching	BRY4	br6													0.40	0.40	
	Lace Bryozoans	Bryozoan 6 lace	BRY6	br1													1.20	1.20	
Bryozoans Total																	*1.60*	*1.60*	
Cnidarians	Bramble corals	Acabaria sp. (orange)	ACA	brc													0.40	0.40	
	Encrusting octocor	Erythropodium hicksoni	OCT	oct							0.40	0.40							
	Gorgonian	Pteronisis plumacea	GOR	NA													4.00	4.00	
	Soft corals	Capnella spp. - brown	CAPB	socb							1.20	1.20							
		Capnella spp. - yellow	CAPY	socy							1.22	0.80							
		Clavularia spp. - white	CLAV	oc2							0.80	0.49	1.60	1.60			5.63	1.73	
	Zooanthids	Parazoanthus spp.	PARA	yez													0.40	0.40	
Cnidarians Total											*3.62*	*2.89*	*1.60*	*1.60*			*10.43*	*6.53*	
Other Cover	Other Cover	Algal turf	TURF	NA					0.40	0.40	1.60	1.17	2.85	2.38					
		Algal/Hydroid/Silt matrix	AHS	NA							50.68	11.98	30.16	11.75					
		Biogenic Matrix	MATR	NA					0.40	0.40	10.93	2.64	7.62	4.40			3.24	2.09	
		Fine hydroid/bryozoan layer	BREB	breb							1.60	1.60	0.40	0.40	79.56	5.17	12.45	0.98	
Other Cover Total									*0.80*	*0.80*	*64.81*	*17.39*	*41.04*	*18.93*	*79.56*	*5.17*	*15.69*	*3.07*	
Polychaetes	Polychaetes	Terrebellid	TER	NA													0.40	0.40	
Polychaetes Total																	*0.40*	*0.40*	
Sponges	Arborescent spon	Arborescent sponges	-	-									1.60	1.60					
Sponges Total													*1.60*	*1.60*					
Substrate	Substrate	Gravel	GRA	gra									2.40	1.17			0.82	0.82	
		Sand	SAND	san									32.14	7.33	20.04	5.08	70.26	5.41	
		Shells	SHELL	NA											0.40	0.40			
		Silt	SILT	sed							4.28	2.89	0.80	0.80					
Substrate Total											*4.28*	*2.89*	*35.34*	*9.30*	*20.44*	*5.48*	*71.08*	*6.23*	
Unscorable	Unscorable	unscorable	UNS	NA	1.20	0.80	0.80	0.80	0.80	0.80	4.00	2.19	0.40	0.40	0.40	0.40	0.40	0.40	
Unscorable Total					*1.20*	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*	*4.00*	*2.19*	*0.40*	*0.40*	*0.40*	*0.40*	*0.40*	*0.40*	
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		

Appendix Table 19.Quantitative estimates of percentage cover at Beabey Point T1 in 2002

			0m (5)		0.5m (7)		1m (6)		2m (15)		5m (21)		10m (13)		15m (16)		17m (1)	
Site	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	alg	Unidentified algae	0	0	8	8	0	0	0	0	0	0	0	0	0	0	0	0
Algae-brown	car	*Carpoglossum confluens*	0	0	42.3	16.7	12.3	8.27	7.2	3.79	0	0	0	0	0	0	0	0
	cys	*Cystophora* sp.	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	3.71	3.71	84.7	7.26	30.9	9.58	0	0	0	0	0	0	0	0
	enc	Encrusting corralines	0	0	0	0	2	2	14.9	5.21	4	1.88	0	0	0	0	0	0
	hor	*Hormisira banksii*	34.8	14.6	2.94	2.12	0	0	0	0	0	0	0	0	0	0	0	0
	mac	*Macrocystis pyrifera*	0	0	26.9	16.3	0	0	17.2	8.5	0	0	0	0	0	0	0	0
	scy	*Scytosiphon lomentaria*	6.8	6.8	0.97	0.97	0	0	0	0	0	0	0	0	0	0	0	0
	xip	*Xiphophora gladiata*	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
Algae-green	ulv	*Ulva* spp.	56.8	12.8	2.68	1.88	0	0	0	0	0	0	0	0	0	0	0	0
	rho	*Rhodymenia* spp.	0	0	0	0	0	0	0	0	0.2	0.2	0	0	0	0	0	0
	son	*Sonderopelta coriaceae*	0	0	0	0	0	0	0	0	2.5	1.68	0	0	0	0	0	0
	tha	*Thamnoclonium dichotomum*	0	0	0	0	0	0	0.8	0.8	21.3	5.34	0	0	0	0	0	0
Total algae	tota		98.4		91.4		101		71.1		28		0		0		0	
Cnidarians	oct	Common octocoral	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0.38	0	0
	soc	Soft coral	0	0	0	0	0	0	0	0	0.1	0.1	0	0	0	0	0	0
	whi	Seawhips	0	0	0	0	0	0	0	0	0.3	0.21	0	0	0	0	0	0
Total cnidarians	totc		0		0		0		0		0.4		0		0.38		0	
Sponges	cus	Cup sponge	0	0	0	0	0	0	0	0	0.1	0.1	0	0	0.5	0.5	0	0
	spo	Sponge u/i usually flat	0	0	0	0	0	0	0	0	2.7	0.89	0.77	0.36	2.25	0.89	6	0
Total sponges	tots		0		0		0		0		2.8		0.77		2.75		6	
Bryozoans	bry	Lace bryozoan, unidentified	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0.13	0	0
Total bryozoans	totb		0		0		0		0		0		0		0.13		0	
Ascidians	asc	Ascidian u/I	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0.38	0	0
	yta	Yellow-throated ascidian	0	0	0	0	0	0	0	0	0	0	0.15	0.15	0.13	0.13	0	0
Echinoderms	ber	Basketstar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
	tom	*Tosia magnifica*	0	0	0	0	0	0	0	0	0.1	0.1	0	0	0.25	0.17	0	0
Other Cover	breb	Fine hydroid/bryozoan layer	0	0	0	0	0	0	27.1	8.37	25.7	6.89	0	0	7.88	6.17	4	0
	uid	Unidentified cover	1.6	1.6	0.23	0.23	0	0	0	0	0	0	0	0	0	0	0	0
Substrate	bre	Bare reef	0	0	0	0	3	1.44	27.6	8.27	26.3	6.8	0	0	7.63	5.93	0	0
	gra	Gravel	0	0	0	0	0	0	0	0	5	4.88	0	0	0	0	0	0
	grs	Gravel with shells	0	0	0	0	0	0	0	0	0	0	0	0	12.5	8.54	0	0
	san	Sand	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0.25	0	0
	sed	Sediment, usually fine	0	0	0	0	0	0	1.33	1.33	25.9	7.35	99.1	0.37	12.6	8.53	90	0
	sgr	Sand/gravel	0	0	0	0	0	0	0	0	15	7.99	0	0	58.8	12	0	0
Total substrate	totsub		0		0		3		28.9		72.2		99.1		91.8		90	

Appendix Table 20.Quantitative estimates of percentage cover at Forrester Point T1 in 2010

Forrester Point T1																	
					Depth												
					0.5m		1m		2m		5m		10m		15m		20m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Carpoglossum confluens	CAR	car	20.99	7.07	40.01	16.49	3.59	2.63								
		Dictyopteris muelleri	NB22	NA	0.40	0.40												
		Ecklonia radiata	ECK	eck	6.95	6.43	51.72	17.70	55.22	13.42	0.54	0.54						
		Hormisira banksii	HOR	hor	20.00	6.38												
		Sargassum sp.	SAR	Sar	25.54	10.48												
	Green algae	Algal Mat Green	AMG	NA							0.16	0.16						
	Red algae	encrusting coralline	ECO	enc					3.06	1.95								
		Foliose red algae	FORE	fore							0.96	0.96						
		Geniculate coralline algae	GCO	gco							0.34	0.23						
		Peyssonnelia spp.	PEY	pey							0.49	0.49						
	Unidentified algae	Unidentified algae	UNA	unka	2.13	1.17	0.41	0.41	0.47	0.47								
		Unidentified algae - drift	DRIFT	dri					2.40	2.40								
		Unidentified algae - filamentous	FIL	NA							0.99	0.70						
Algae Total					*76.01*	*31.93*	*92.14*	*34.59*	*64.73*	*20.86*	*3.48*	*3.08*						
Ascidians	Colonial ascidians	Ascidian 12 colonial	NB60	NA							0.17	0.17						
		Ascidian 17 colonial - cf Sigillina spp.	AS9	as8							0.65	0.65						
		Ascidian 22 colonial	NB71	as9							0.59	0.59						
		Ascidian 5 colonial	NB33	NA							0.48	0.35	0.82	0.82				
	Encrusting ascidians	Ascidian 14 encrusting	NB62	NA							0.24	0.24	2.55	2.55			0.51	0.51
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1									0.41	0.41				
		Ascidian 18 solitary	NB65	NA	0.40	0.40												
		Ascidian 19 solitary	NB67	NA							0.16	0.16						
		Ascidian unidentified	ASC	asc							0.69	0.51			0.40	0.40		
		Herdmania grandis	AS2	rta							0.41	0.28						
		Polycarpa viridis	AS8	?							0.16	0.16						
Ascidians Total					*0.40*	*0.40*					*3.58*	*3.13*	*3.78*	*3.78*	*0.40*	*0.40*	*0.51*	*0.51*
Bivalves	Mussels bivalve	Mytilus edulis	MYT	myt	0.43	0.43												
Bivalves Total					*0.43*	*0.43*												
Bryozoans	Branching Bryozoans	Adeonellopsis parvipuncta	BRY5	br7							0.24	0.24						
		Bryozoan 13 Caberea like 2	BRY13	NA							0.94	0.42						
		Hornea robusta	BRY3	br5											1.23	0.51		
	Lace Bryozoans	Bryozoan 6 lace	BRY6	br1							1.70	0.77					0.50	0.50
Bryozoans Total											*2.88*	*1.43*			*1.23*	*0.51*	*0.50*	*0.50*

Continued on next page..

Appendix Table 20 *continued*. Quantitative estimates of percentage cover at Forrester Point T1 in 2010

Forrester Point T1 continued																	
					Depth												
					0.5m		**1m**		**2m**		**5m**		**10m**		**15m**		**20m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Cnidarians	Bramble corals	Acabaria sp. (orange)	ACA	brc							0.21	0.21						
	Encrusting octocorals	Erythropodium hicksoni	OCT	oct							1.57	1.57						
	Hydroids	Hydroid 1	HYD1	hyd							0.24	0.24						
	Sea Whips	?Primnoella australasiae	SW	whi							5.06	2.21						
	Soft corals	Capnella spp. - brown	CAPB	socb							0.39	0.26						
		Clavularia spp. - white	CLAV	oc2							32.33	4.49	9.72	4.36	3.42	2.48	5.46	1.77
	Solitary coral	Solitary coral 1	COR	sco							0.43	0.43						
	Zooanthids	Parazoanthus spp.	PARA	yez							3.61	3.61	0.41	0.41	0.85	0.85	0.42	0.42
Cnidarians Total											*43.84*	*13.02*	*10.13*	*4.77*	*4.27*	*3.33*	*5.87*	*2.18*
Echinoderms	Urchins	Goniocidaris tubaria	GON	gon							0.16	0.16						
Echinoderms Total											*0.16*	*0.16*						
Other Cover	Other Cover	Algal turf	TURF	NA	21.49	9.05	7.86	4.84	35.27	14.60								
		Algal/Hydroid/Silt matrix	AHS	NA							17.53	6.15						
		Biogenic Matrix	MATR	NA							10.12	5.63	1.77	0.85	0.43	0.43	1.46	0.60
		Fine hydroid/bryozoan layer	BREB	breb							9.81	3.35	51.44	16.81	12.76	5.87	17.20	5.66
		Fine sediment cover on bare reef	BRES	bres							0.70	0.70						
Other Cover Total					*21.49*	*9.05*	*7.86*	*4.84*	*35.27*	*14.60*	*38.16*	*15.82*	*53.21*	*17.66*	*13.19*	*6.30*	*18.66*	*6.25*
Polychaetes	Polychaetes	Galeolaria sp.	GAL	gal							0.24	0.24						
		Serpulid	SER	NA									0.41	0.41				
Polychaetes Total											*0.24*	*0.24*	*0.41*	*0.41*				
Sponges	Arborescent sponges	Arborescent sponges	-	-							1.69	1.16			0.43	0.43		
	Cup sponges	Cup sponges	-	-									1.82	1.82	0.83	0.51	6.52	3.56
	Encrusting sponges	Encrusting sponges	-	-							1.58	0.56						
	Globular sponges	Globular sponges	-	-							0.16	0.16						
	Lumpy sponges	Lumpy sponges	-	-							0.36	0.25						
	Massive sponges	Massive sponges	-	-							0.59	0.31						
	Papillate sponge	Papillate sponge	-	-							0.50	0.36						
Sponges Total											*4.89*	*2.80*	*1.82*	*1.82*	*1.26*	*0.94*	*6.52*	*3.56*
Substrate	Substrate	Gravel	GRA	gra							0.16	0.16	0.41	0.41			0.42	0.42
		Reef	BRE	bre	1.25	0.85					0.31	0.31	2.49	1.50	1.25	0.85	2.08	2.08
		Rubble	BRUB	NA							0.16	0.16			0.83	0.51	0.92	0.57
		Sand	SAND	san							1.98	0.95	27.76	19.26	77.55	9.68	64.51	10.45
		Shells	SHELL	NA	0.43	0.43					0.16	0.16						
Substrate Total					*1.68*	*1.27*					*2.77*	*1.74*	*30.66*	*21.16*	*79.64*	*11.03*	*67.93*	*13.52*
Unscorable	Unscorable	unscorable	UNS	NA	5.20	1.36	1.60	1.17	2.80	2.80	12.77	2.90	6.40	2.48	2.80	1.74	11.20	4.32
Unscorable Total					*5.20*	*1.36*	*1.60*	*1.17*	*2.80*	*2.80*	*12.77*	*2.90*	*6.40*	*2.48*	*2.80*	*1.74*	*11.20*	*4.32*
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 21.Quantitative estimates of percentage cover at Forrester Point T1 in 2002

		Depth (replicates)	1m (5)		2m 96)		5m (15)		10m (16)		15m (16)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	car	*Carpoglossum confluens*	16	10.3	10.4	6.77	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	39.2	16	0	0	0	0	0	0
	hor	*Hormisira banksii*	4.4	3.12	0	0	0	0	0	0	0	0
Algae-green	ulv	*Ulva* spp.	78.8	11.4	0	0	0	0	0	0	0	0
Algae-red	enc	Encrusting corralines	0	0	0	0	3.2	2.18	0	0	0	0
	tha	Thamnoclonium dichotomum	0	0	0	0	8.27	3.78	0	0	0	0
Total algae			99.2		49.6		11.5		0		0	
Cnidarians	oct	Common octocoral	0	0	0	0	6.93	2.87	0.75	0.75	3.13	1.66
	brc	Stoloniferous octocoral (bramble coral)	0	0	0	0	0	0	0.25	0.25	0	0
	whi	Seawhips	0	0	0	0	12	2.75	5.63	1.66	0	0
	yez	Yellow zooanthid	0	0	0	0	0	0	0	0	0.5	0.39
Total cnidarians			0		0		18.9		6.63		3.63	
Sponges	cus	Cup sponge	0	0	0	0	0	0	0.25	0.25	5.38	1.75
	fso	Finger sponge-orange	0	0	0	0	0	0	0	0	0.38	0.38
	fsw	Fnger sponge-white,cf orange	0	0	0	0	0	0	0	0	0.38	0.38
	sp11	Large grey sponge, spines	0	0	0	0	0	0	1.63	1.63	0	0
	sp2	Sponge finger, very fine white/grey	0	0	0	0	0.93	0.93	0.25	0.25	0	0
	spo	Sponge u/i usually flat	0	0	0	0	6.67	1.13	2	0.89	4.5	1.06
Total sponges			0		0		7.6		4.13		10.6	
Bryozoans	brf	Lace bryozoan 5	0	0	0	0	0	0	0.5	0.5	0.13	0.13
	bry	Lace bryozoan, unidentified	0	0	0	0	0	0	0.5	0.34	0.63	0.51
Total bryozoans			0		0		0		1		0.75	
Ascidians	as2	Ascidian colonial stalked.	0	0	0	0	0	0	0.25	0.25	0	0
	as5	colonial ascidian 2	0	0	0	0	0	0	1.25	0.7	0	0
	wta	White throated ascidian	0	0	0	0	0.13	0.13	0	0	0	0
Molluscs	myt	*Mytilus edulis*	0.4	0.4	0	0	0	0	0	0	0	0
Echinoderms	bas	Basketstar	0	0	0	0	0	0	0.75	0.4	0	0
	gon	*Goniocidaris tubaria*	0	0	0	0	0.27	0.18	0	0	0	0
	tom	*Tosia magnifica*	0	0	0	0	0	0	0.13	0.13	0	0
Other Cover	breb	Fine hydroid/bryozoan layer	0	0	47.6	19.4	58.4	5.76	50.5	9.3	76.8	4.87
	uid	Unidentified cover	0	0	0	0	0	0	0	0	0.38	0.38
Substrate	bre	Bare reef	0	0	47.6	19.4	59.6	5.5	65.9	7.28	77	5.74
	san	Sand	0	0	0	0	0	0	10	5.65	0.63	0.63
	sed	Sediment, usually fine	0	0	0	0	3.33	3.33	10.5	5.58	6	3.29
	sgr	Sand/gravel	0	0	0	0	0.53	0.53	0	0	0	0
Total substrate			0		47.6		63.5		86.4		83.6	

Appendix Table 22.Quantitative estimates of percentage cover at Forrester Point T2 in 2010

Forrester Point T2																				
					Depth															
					0.5m		1m		2m		3m		5m		10m		15m		20m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Carpoglossum confluens	CAR	car	42.10	6.81	20.14	10.83					1.17	0.89						
		Ecklonia radiata	ECK	eck	22.61	8.54	75.71	12.30	47.11	17.31	17.58	9.66	1.60	1.60						
		Hormisira banksii	HOR	hor	3.66	1.19														
		Sargassum sp.	SAR	Sar	24.32	7.07														
	Green algae	Ulva spp.	ULV	uvl									0.13	0.13						
	Red algae	encrusting coralline	ECO	enc	1.62	1.19					2.88	1.78	0.76	0.43						
		Foliose red algae	FORE	fore									0.15	0.15						
		Geniculate coralline algae	GCO	gco									0.14	0.14						
		Peyssonnelia spp.	PEY	pey									1.56	0.76						
		Thamnoclonium dichotomum	THAM	tham							1.21	0.80	2.22	0.91						
	Unidentified algae	Unidentified algae	UNA	unka	0.80	0.49														
		Unidentified algae - drift	DRIFT	dri									0.16	0.16	0.43	0.43				
		Unidentified algae - erect branching	EBA	NA							2.00	2.00								
		Unidentified algae - filamentous	FIL	NA									0.15	0.15						
		Unidentified algae - foliose	FOL	NA							0.81	0.49								
Algae Total					*95.12*	*25.28*	*95.85*	*23.13*	*47.11*	*17.31*	*24.47*	*14.74*	*8.02*	*5.31*	*0.43*	*0.43*				
Ascidians	Colonial ascidians	Ascidian 12 colonial	NB60	NA							0.80	0.80	0.32	0.32						
		Ascidian 22 colonial	NB71	as9									0.38	0.28						
		Ascidian 5 colonial	NB33	NA									1.31	0.69						
	Encrusting ascidians	Ascidian 14 encrusting	NB62	NA													0.40	0.40	0.40	0.40
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1									0.51	0.29						
		Ascidian 16 solitary - white-throat	AS3	wta									0.48	0.36						
		Herdmania grandis	AS2	rta									0.28	0.19						
Ascidians Total											*0.80*	*0.80*	*3.28*	*2.13*			*0.40*	*0.40*	*0.40*	*0.40*
Bryozoans	Branching Bryozoans	Bryozoan 13 Caberea like 2	BRY13	NA									1.07	0.40						
		Hornea robusta	BRY3	br5													1.29	0.84		
	Lace Bryozoans	Bryozoan 6 lace	BRY6	br1									0.65	0.31	0.95	0.58	4.98	1.87	1.22	1.22
Bryozoans Total													*1.73*	*0.70*	*0.95*	*0.58*	*6.27*	*2.71*	*1.22*	*1.22*
Cnidarians	Encrusting octocorals	Erythropodium hicksoni	OCT	oct							2.04	2.04								
	Sea Whips	?Primnoella australasiae	SW	whi									5.56	1.44						
	Soft corals	Capnella spp. - brown	CAPB	socb							1.22	1.22								
		Capnella spp. - yellow	CAPY	socy							15.30	6.13								
		Clavularia spp. - white	CLAV	oc2							0.81	0.49	37.25	4.29	40.89	10.77	20.84	6.45	11.53	4.04
	Zooanthids	Parazoanthus spp.	PARA	yez													14.90	12.50	8.21	6.31
Cnidarians Total											*19.38*	*9.89*	*42.80*	*5.73*	*40.89*	*10.77*	*35.74*	*18.96*	*19.74*	*10.34*

Appendix Table 22 *continued*. Quantitative estimates of percentage cover at Forrester Point T2 in 2010

Forrester Point T2 *continued*																					
					Depth																
					0.5m		**1m**		**2m**		**3m**		**5m**		**10m**		**15m**		**20m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Echinoderms	Sea Stars	Tosia magnifica	TOM	tom									0.13	0.13					0.43	0.43
	Urchins	Goniocidaris tubaria	GON	gon									0.14	0.14						
		Heliocidaris erythrogramma	HEL	hel									0.13	0.13						
Echinoderms Total													*0.40*	*0.40*					*0.43*	*0.43*
Other Cover	Other Cover	Algal turf	TURF	NA	3.65	1.49	4.15	2.65	35.87	17.63	2.98	2.98								
		Algal/Hydroid/Silt matrix	AHS	NA							7.46	4.64	24.26	4.90						
		Biogenic Matrix	MATR	NA					17.02	7.03	41.15	11.63	4.77	1.52			5.35	3.31	3.01	1.34
		Fine hydroid/bryozoan layer	BREB	breb							2.96	2.48	2.77	1.43	31.43	4.79	44.00	5.89	20.53	7.53
		Fine sediment cover on bare reef	BRES	bres									0.15	0.15						
Other Cover Total					*3.65*	*1.49*	*4.15*	*2.65*	*52.89*	*24.66*	*54.54*	*21.73*	*31.95*	*7.99*	*31.43*	*4.79*	*49.36*	*9.20*	*23.54*	*8.88*
Polychaetes	Polychaetes	Galeolaria sp.	GAL	gal									0.17	0.17						
		Serpulid	SER	NA									1.33	0.66						
Polychaetes Total													*1.50*	*0.83*						
Sponges	Arborescent sponges	Arborescent sponges	-	-							0.81	0.49								
	Cup sponges	Cup sponges	-	-													1.22	1.22	0.82	0.82
	Encrusting sponges	Encrusting sponges	-	-									1.87	0.73			0.40	0.40	2.33	2.33
	Globular sponges	Globular sponges	-	-									0.26	0.26						
	Lumpy sponges	Lumpy sponges	-	-									1.87	0.79						
	Massive sponges	Massive sponges	-	-									0.25	0.17						
	Papillate sponge	Papillate sponge	-	-									0.39	0.28						
	Tubular sponge	Tubular sponge	-	-									0.26	0.17						
Sponges Total											*0.81*	*0.49*	*4.89*	*2.40*			*1.62*	*1.62*	*3.14*	*3.14*
Substrate	Substrate	Gravel	GRA	gra									1.65	0.74	0.40	0.40				
		Reef	BRE	bre	1.23	0.83							0.15	0.15					0.80	0.80
		Sand	SAND	san									3.22	1.68	25.42	11.84	6.61	2.91	49.87	15.73
		Shells	SHELL	NA									0.13	0.13	0.47	0.47				
		Silt	SILT	sed									0.29	0.29					0.85	0.85
Substrate Total					*1.23*	*0.83*							*5.43*	*2.99*	*26.29*	*12.70*	*6.61*	*2.91*	*51.52*	*17.38*
Unscorable	Unscorable	unscorable	UNS	NA	1.20	0.80	2.00	1.26	1.20	0.49	2.40	0.98	11.13	2.32	9.20	3.14	4.80	3.01	4.80	2.50
Unscorable Total					*1.20*	*0.80*	*2.00*	*1.26*	*1.20*	*0.49*	*2.40*	*0.98*	*11.13*	*2.32*	*9.20*	*3.14*	*4.80*	*3.01*	*4.80*	*2.50*
Grand total (% scored)					*100*		*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 23.Quantitative estimates of percentage cover at Forrester Point T2 in 2002

		Depth (replicates)	2m (15)		5m (12)		10m (21)		15m (19)		20m (19)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	eck	*Ecklonia radiata*	30.7	9.38	0	0	0	0	0	0	0	0
Algae-red	enc	Encrusting corralines	0.53	0.53	1	0.83	0	0	0	0	0	0
	tha	*Thamnoclonium dichotomum*	1.07	1.07	0.33	0.33	0	0	0	0	0	0
Total algae			32.3		1.33		0		0		0	
Cnidarians	oct	Common octocoral	0	0	3.5	2.36	9.8	2.36	1.37	0.68	1.11	0.88
	soc	Soft coral	0.27	0.27	0	0	0	0	0	0	0	0
	whi	Seawhips	0	0	28	9.29	1.6	0.59	0	0	0.22	0.15
	yez	Yellow zooanthid	0	0	0	0	0.4	0.23	0.95	0.56	0.56	0.26
Total cnidarians			0.27		31.5		11.8		2.32		1.89	
Sponges	cus	Cup sponge	0	0	0	0	2.4	0.92	5.89	1.48	8.89	2.5
	fsfw	Finger sponge fine white,*Thamnoclonium*?	0	0	0	0	0	0	0.53	0.53	0.33	0.32
	fsk	Finger sponge knobby	0	0	0	0	0	0	0	0	0.22	0.22
	fso	Finger sponge-orange	0	0	0	0	0	0	0.53	0.53	1.33	0.72
	fsu	Finger sponge fine brown	0	0	0	0	0.2	0.2	0.32	0.32	0	0
	jhs	Jokers hat sponge	0	0	0	0	0.1	0.1	0	0	0	0
	spf	sponge, flattened, broad, branched, pink	0	0	0	0	0	0	0	0	0.33	0.32
	spo	Sponge u/i usually flat	0	0	9	2.15	12	2.53	5.26	1.21	6.78	1.5
Total sponges			0	0	9	2.15	14.7	3.75	12.5	4.05	17.9	5.59
Bryozoans	br5	Branching bryozoan 1	0	0	0	0	0	0	0	0	0.33	0.32
	brf	Lace bryozoan 5	0	0	0	0	0.6	0.59	1.26	0.72	2.11	1.45
	brg	Lace Bryozoan 6	0	0	0	0	0.1	0.1	0.42	0.25	0.22	0.22
	bry	Lace bryozoan, unidentified	0	0	0	0	0.1	0.1	0.11	0.11	0	0
Total bryozoans			0		0		0.8		1.79		2.67	
Ascidians	as6	Colonial ascidian 3, scallop shape	0	0	0	0	0.3	0.29	0.11	0.11	0	0
	wta	White throated ascidian	0	0	0	0	0.1	0.1	0	0	0	0
Echinoderms	bas	Basketstar	0	0	0	0	0.2	0.13	0	0	0	0
	gon	*Goniocidaris tubaria*	0	0	0	0	0	0	0	0	0.11	0.11
	tom	*Tosia magnifica*	0	0	0	0	0	0	0.11	0.11	0.11	0.11
Other Cover	breb	Fine hydroid/bryozoan layer	0	0	65.3	7.06	59.5	5.32	47.9	10.3	50.9	6.83
	uid	Unidentified cover	2.67	2.67	1	1	0	0	0	0	3.78	2.53
Substrate	bre	Bare reef	64.8	9.93	58.3	8.03	61.5	4.99	74.1	4.55	53.6	5.9
	san	Sand	0	0	0	0	4.8	3.15	4.11	4.11	0.22	0.22
	sed	Sediment, usually fine	0	0	0	0	0.4	0.39	4.84	3.6	20.2	6.35
Total substrate			64.8		58.3		66.7		83.1		74	

Appendix Table 24.Quantitative estimates of percentage cover at Forrester Point T3 in 2010

Forrester Point T3																	
					Depth												
					0.5m		**1m**		**2m**		**5m**		**10m**		**15m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Algae	Brown algae	Ecklonia radiata	ECK	eck	43.60	15.25	60.00	24.49								
	Red algae	Thamnoclonium dichotomum	THAM	tham					2.00	2.00						
	Unidentified algae	Unidentified algae - erect branching	EBA	NA	2.40	1.17										
Algae Total					*46.00*	*16.42*	*60.00*	*24.49*	*2.00*	*2.00*						
Ascidians	Solitary ascidians	Herdmania grandis	AS2	rta									0.40	0.40		
Ascidians Total													*0.40*	*0.40*		
Other Cover	Other Cover	Algal/Hydroid/Silt matrix	AHS	NA	54.00	15.94	40.00	24.49	2.00	2.00						
		Biogenic Matrix	MATR	NA					0.40	0.40	0.41	0.41				
		Bioturbation	BIOT	NA											2.00	0.89
		Fine hydroid/bryozoan layer	BREB	breb					72.00	4.52	14.51	4.79	7.60	3.82		
Other Cover Total					*54.00*	*15.94*	*40.00*	*24.49*	*74.40*	*6.92*	*14.92*	*5.20*	*7.60*	*3.82*	*2.00*	*0.89*
Sponges	Globular sponges	Globular sponges	-	-					0.40	0.40						
	Lumpy sponges	Lumpy sponges	-	-							0.40	0.40				
Sponges Total									*0.40*	*0.40*	*0.40*	*0.40*				
Substrate	Substrate	Gravel	GRA	gra					22.80	3.20						
		Sand	SAND	san							84.28	4.80	92.00	3.63		
		Shells	SHELL	NA					0.40	0.40	0.40	0.40				
		Silt	SILT	sed											98.00	0.89
Substrate Total									*23.20*	*3.60*	*84.68*	*5.20*	*92.00*	*3.63*	*98.00*	*0.89*
Unscorable	Unscorable	unscorable	UNS	NA			6.00	2.53			0.40	0.40				
Unscorable Total							*6.00*	*2.53*			*0.40*	*0.40*				
Grand total					*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 25.Quantitative estimates of percentage cover at Forrester Point T3 in 2002

		Depth (replicates)	0.5m (10)		1m (10)		2m (19)		5m (15)		10m (11)		15m (12)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	alg	Unidentified algae	4	4	0	0	0	0	0	0	0	0	0	0
Algae-brown	car	*Carpoglossum confluens*	9.2	9.2	18.8	11.9	1.75	1.61	0	0	0	0	0	0
	eck	*Ecklonia radiata*	2.8	2.8	38.8	16.8	32.3	8.7	0	0	0	0	0	0
	hor	*Hormisira banksii*	36.8	14.9	0	0	0	0	0	0	0	0	0	0
Algae-green	ulv	*Ulva* spp.	16	4.52	0	0	0	0	0	0	0	0	0	0
Algae-red	enc	Encrusting corralines	0	0	0	0	0.63	0.4	1.07	0.13	0	0	0	0
	red	Red rock. *Peysionella* spp?	0	0	0	0	0.38	0.34	0	0	0	0	0	0
	tha	*Thamnoclonium dichotomum*	0	0	0	0	4.5	2.17	2.4	0.29	0	0	0	0
	tre	Thallose red algae	6	2.45	0	0	0	0	0	0	0	0	0	0
Total algae			74.8		57.6		39.5		3.47		0		0	
Cnidarians	oct	Common octocoral	0	0	0	0	0	0	0.67	0.12	0.18	0.05	0	0
	an2	Common tube anemone	0	0	0	0	0	0	0	0	0	0	0.67	0.67
	whi	Seawhips	0	0	0	0	0	0	0.4	0.1	0	0	0	0
Total cnidarians			0		0		0		1.07		0.18		0.67	
Sponges	fso	Finger sponge-orange	0	0	0	0	0	0	0.53	0.11	1.45	0.38	0	0
	spo	Sponge u/i usually flat	0	0	0	0	0.25	0.23	1.6	0.17	0.55	0.08	0	0
Total sponges			0		0		0.25		2.13		2		0	
Ascidians	wta	White throated ascidian	0	0	0	0	0	0	0	0	0	0	0.17	0.17
Molluscs	myt	*Mytilus edulis*	1.2	1.2	0	0	0	0	0	0	0	0	0	0
Echinoderms	pat	*Patiriella brevispinna*	0	0	0	0	0	0	0.13	0.03	0	0	0	0
Other Cover	breb	Fine hydroid/bryozoan layer	0	0	0	0	42.4	9.01	31.2	1.5	10.5	2.1	0	0
Substrate	bre	Bare reef	23.6	5.64	42.4	12.9	55.9	7.7	31.2	1.5	10.5	2.1	0	0
	cob	Cobble	0	0	0	0	0	0	0	0	36.2	4.56	0	0
	gra	Gravel	0	0	0	0	1	0.92	0	0	14	2.91	0	0
	grs	Gravel with shells	0	0	0	0	0	0	0	0	37.1	4.28	0	0
	san	Sand	0	0	0	0	3	1.6	2.27	0.59	0	0	0	0
	sed	Sediment, usually fine	0	0	0	0	0	0	0	0	0	0	99.2	0.67
	sgr	Sand/gravel	0	0	0	0	0.38	0.34	54.3	2.21	0	0	0	0
Total substrate			23.6		42.4		60.3		87.7		97.8		99.2	

Appendix Table 26.Quantitative estimates of percentage cover at Munday Island T1 in 2010

Munday Island T1																	
					Depth												
					0.5m		1m		2m		3m		5m		10m		15m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Carpoglossum confluens	CAR	car	80.40	11.74	38.90	13.00	5.15	2.01	1.20	1.20						
		Dictyopteris muelleri	NB22	NA			4.65	4.65	0.43	0.43	1.74	1.74						
		Ecklonia radiata	ECK	eck	18.80	12.03	48.83	16.53	31.78	10.16	0.41	0.41						
	Green algae	Codium spp.	COD	cos					0.43	0.43								
	Red algae	encrusting coralline	ECO	enc			0.82	0.82	4.54	3.56			0.16	0.16				
		Foliose red algae	FORE	fore									4.67	1.60				
		Geniculate coralline algae	GCO	gco									1.11	0.49				
		Phacelocarpus pepperocarpos	PHA	pha							31.20	16.08						
		Sonderopelta coriacea	SOND	son									0.16	0.16				
		Thamnoclonium dichotomum	THAM	tham					1.90	1.42	1.23	0.81	0.95	0.55				
	Unidentified algae	Unidentified algae	UNA	unka	0.80	0.80	3.76	2.34										
		Unidentified algae - drift	DRIFT	dri							0.41	0.41	0.31	0.31				
		Unidentified algae - filamentous	FIL	NA									0.83	0.57				
Algae Total					*100.00*	*24.56*	*96.95*	*37.33*	*44.22*	*18.00*	*36.19*	*20.65*	*8.18*	*3.84*				
Ascidians	Colonial ascidians	Ascidian 5 colonial	NB33	NA									0.47	0.25				
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp	AS1	as1									0.68	0.29	0.40	0.40	2.49	1.22
		Ascidian 16 solitary - white-throat	AS3	wta									0.70	0.47				
		Ascidian unidentified	ASC	asc													0.41	0.41
Ascidians Total													*1.85*	*1.02*	*0.40*	*0.40*	*2.90*	*1.62*
Bryozoans	Branching Bryozoans	Adeonellopsis parvipuncta	BRY5	br7									0.17	0.17				
		Bryozoan 13 Caberea like 2	BRY13	NA									0.32	0.22				
	Lace Bryozoans	Bryozoan 11 lace	BRY11	bryc									0.37	0.37				
		Bryozoan 6 lace	BRY6	br1									0.82	0.30				
Bryozoans Total													*1.67*	*1.05*				
Cnidarians	Bramble corals	Acabaria sp. (orange)	ACA	brc											2.09	1.31	0.42	0.42
	Encrusting octocorals	Erythropodium hicksoni	OCT	oct							0.43	0.43						
	Sea Whips	?Primnoella australasiae	SW	whi									3.04	0.89	0.87	0.87		
	Soft corals	Capnella spp. - brown	CAPB	socb							0.43	0.43						
		Clavularia spp. - white	CLAV	oc2							4.26	2.84	35.40	3.51	39.70	6.37	37.90	3.56
Cnidarians Total											*5.13*	*3.71*	*38.44*	*4.39*	*42.66*	*8.56*	*38.31*	*3.97*
Echinoderms	Urchins	Goniocidaris tubaria	GON	gon									0.34	0.23				
Echinoderms Total													*0.34*	*0.23*				
Other Cover	Other Cover	Algal turf	TURF	NA					43.92	8.64	39.35	9.50	0.78	0.36				
		Algal/Hydroid/Silt matrix	AHS	NA			1.82	1.35	5.37	3.84	1.27	0.86	1.24	0.77				
		Biogenic Matrix	MATR	NA			1.22	1.22	6.49	3.36	7.15	4.54	10.88	3.05	9.59	1.19	5.32	1.36
		Fine hydroid/bryozoan layer	BREB	breb									18.89	4.34	10.98	1.69	13.60	3.47
Other Cover Total							*3.05*	*2.58*	*55.78*	*15.84*	*47.76*	*14.90*	*31.79*	*8.53*	*20.58*	*2.88*	*18.91*	*4.83*

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Appendix Table 26 *continued*. Quantitative estimates of percentage cover at Munday Island T1 in 2010

Munday Island T1 *continued*																	
					Depth												
					0.5m		**1m**		**2m**		**3m**		**5m**		**10m**		**15m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Polychaetes	Polychaetes	Serpulid	SER	NA									0.81	0.51			0.83	0.51
Polychaetes Total													*0.81*	*0.51*			*0.83*	*0.51*
Sponges	Encrusting sponges	Encrusting sponges	-	-									0.63	0.35				
	Lumpy sponges	Lumpy sponges	-	-									0.18	0.18				
Sponges Total													*0.81*	*0.54*				
Substrate	Substrate	Cobble	COB	cob									0.16	0.16				
		Gravel	GRA	gra							0.80	0.80	1.57	0.57			3.25	1.86
		Rubble	BRUB	NA							0.82	0.82			0.82	0.82		
		Sand	SAND	san							9.30	4.24	14.23	1.82	34.70	5.27	32.11	1.71
		Shells	SHELL	NA									0.15	0.15	0.84	0.52	3.67	1.48
Substrate Total											*10.92*	*5.85*	*16.11*	*2.71*	*36.36*	*6.60*	*39.04*	*5.05*
Unscorable	Unscorable	unscorable	UNS	NA	0.40	0.40	5.20	2.42	8.40	2.64	2.00	1.55	3.69	1.26	4.40	1.60	2.80	0.80
Unscorable Total					*0.40*	*0.40*	*5.20*	*2.42*	*8.40*	*2.64*	*2.00*	*1.55*	*3.69*	*1.26*	*4.40*	*1.60*	*2.80*	*0.80*
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 27.Quantitative estimates of percentage cover at Munday Island T1 in 2002

		Depth (replicates)	0m (4)		1m (4)		5m (15)		10m (20)		20m (19)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	car	*Carpoglossum confluens*	0	0	17.5	11.1	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	79.5	14	0	0	0	0	0	0
	hor	*Hormisira banksii*	47.5	6.29	0	0	0	0	0	0	0	0
Algae-green	cha	*Chaetomorpha billardierii*	1	1	0	0	0	0	0	0	0	0
	cos	*Codium* spp.	0	0	0	0	0.8	0.8	0	0	0	0
	fgr	Fillamentous greens	4.5	4.5	0	0	0	0	0	0	0	0
	ulv	*Ulva* spp.	42.5	14.9	0	0	0	0	0	0	0	0
Algae-red	enc	Encrusting corralines	0	0	3	3	2.8	2.13	0	0	0	0
	fre	Fillamentous reds	4.5	4.5	0	0	0	0	0	0	0	0
	tha	*Thamnoclonium dichotomum*	0	0	0	0	6.8	2.44	0	0	0	0
Total algae			100		100		10.4		0		0	
Cnidarians	oct	Common octocoral	0	0	0	0	0.4	0.4	0.8	0.8	0.22	0.22
	soc	Soft coral	0	0	0	0	0.13	0.13	0	0	0	0
	whi	Seawhips	0	0	0	0	27.5	4.12	1.3	0.51	0	0
	yez	Yellow zooanthid	0	0	0	0	0	0	0	0	0.33	0.32
Total cnidarians			0		0		28		2.1		0.56	
Sponges	cus	Cup sponge	0	0	0	0	0	0	0.2	0.2	0	0
	cus2	Cup sponge. Spiral form.	0	0	0	0	0	0	0.1	0.1	0	0
	fso	Finger sponge-orange	0	0	0	0	1.07	0.61	0	0	0	0
	sp10	sponge, pink broad, branching	0	0	0	0	0	0	0	0	0.22	0.22
	sp3	Finger sponge 3, fine white/grey	0	0	0	0	0.13	0.13	0	0	0.22	0.22
	spo	Sponge u/i usually flat	0	0	0	0	9.87	1.37	8.6	2.11	15.3	2.42
Total sponges			0		0		11.1		8.9		15.8	
Bryozoans	br1	Lace bryozoan 1	0	0	0	0	0	0	0.2	0.2	0	0
	brf	Lace bryozoan 5	0	0	0	0	0	0	1.2	0.93	0	0
	brg	Lace Bryozoan 6	0	0	0	0	0	0	0.2	0.2	0	0
	bry	Lace bryozoan, unidentified	0	0	0	0	0	0	0.2	0.2	0	0
Total bryozoans			0		0		0		1.8		0	
Ascidians	as1	Ascidian solitary 1	0	0	0	0	0	0	0.4	0.4	0	0
	as4	Colonial ascidian 9, blue golfball.	0	0	0	0	0	0	0.1	0.1	0	0
	wta	White throated ascidian	0	0	0	0	0.13	0.13	0.1	0.1	0	0
Echinoderms	bas	Basketstar	0	0	0	0	0.27	0.18	0.1	0.1	0	0
	gon	*Goniocidaris tubaria*	0	0	0	0	0	0	0.5	0.29	0.11	0.11
	hel	*Heliocidaris erytrogramma*	0	0	0	0	0.13	0.13	0	0	0	0
	sti	*Stichopus mollis*	0	0	0	0	0.13	0.13	0	0	0	0
	toa	*Tosia australis*	0	0	0	0	0	0	0.1	0.1	0	0
	tom	*Tosia magnifica*	0	0	0	0	0	0	0.1	0.1	0	0
Other Cover	epi	Fine hydroid/bryozoan layer	0	0	0	0	32.9	9.24	40.9	7.13	76.2	2.43
Substrate	bre	Bare reef	0	0	0	0	47.9	4.07	77.8	6.01	79.6	2.33
	gra	Gravel	0	0	0	0	4.67	2.76	0	0	1.22	0.82
	san	Sand	0	0	0	0	0	0	0	0	0.56	0.54
	sgr	Sand/gravel	0	0	0	0	0	0	0	0	2.22	1.48
Total cover			0		0		52.5		77.8		83.6	

Appendix Table 28.Quantitative estimates of percentage cover at Munday Island T2 in 2010

Munday Island T2																					
					Depth																
					0.5m		1m		2m		3m		5m		10m		15m		20m		
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	
Algae	Brown algae	Carpoglossum confluens	CAR	car	64.80	16.60	17.20	17.20	1.33	1.33	1.22	1.22									
		Dictyopteris muelleri	NB22	NA	0.93	0.93	1.20	1.20	3.67	3.67	1.22	1.22									
		Ecklonia radiata	ECK	eck	31.21	15.76	78.57	19.69	21.48	15.34											
		Sargassum sp.	SAR	Sar									0.10	0.10							
	Green algae	Codium spp.	COD	cos									0.20	0.20							
		Ulva spp.	ULV	uvl	0.43	0.43															
	Red algae	encrusting coralline	ECO	enc					0.85	0.52											
		Foliose red algae	FORE	fore									0.22	0.15							
		Peyssonnelia spp.	PEY	pey	0.47	0.47			0.89	0.89											
		Thamnoclonium dichotomum	THAM	tham					3.04	2.17			1.95	0.98							
	Unidentified algae	Unidentified algae	UNA	unka	0.47	0.47															
		Unidentified algae - drift	DRIFT	dri							0.82	0.50	0.19	0.13							
		Unidentified algae - filamentous	FIL	NA									2.18	1.36							
		Unidentified algae - foliose	FOL	NA									0.74	0.62							
Algae Total					*98.31*	*34.65*	*96.97*	*38.09*	*31.27*	*23.92*	*3.27*	*2.95*	*5.59*	*3.54*							
Ascidians	Colonial ascidians	Ascidian 10 colonial	NB58	NA													0.41	0.41	0.42	0.42	
		Ascidian 11 colonial	NB59	NA							2.11	2.11	1.36	0.58							
		Ascidian 12 colonial	NB60	NA									0.94	0.52							
		Ascidian 21 lumpy orange	NB17	NA					0.85	0.52											
		Ascidian 23 colonial orange transluscent	NB73	NA									2.50	0.73							
		Ascidian 5 colonial	NB33	NA									0.83	0.37							
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1									0.25	0.25	0.40	0.40			0.82	0.50	
		Ascidian 16 solitary - white-throat	AS3	wta									0.26	0.18							
		Ascidian unidentified	ASC	asc									0.33	0.18			0.43	0.43			
		Herdmania grandis	AS2	rta									0.12	0.12							
		Polycarpa viridis	AS8	?									0.12	0.12							
Ascidians Total									*0.85*	*0.52*	*2.11*	*2.11*	*6.70*	*3.05*	*0.40*	*0.40*	*0.83*	*0.83*	*1.23*	*0.92*	
Bryozoans	Branching Bryozoans	Bryozoan 12 Caberea like	BRY12	NA									0.15	0.15							
		Bryozoan 13 Caberea like 2	BRY13	NA									0.82	0.32							
		Bryozoan 14 branching (orange flat)	NB11	NA					0.41	0.41			0.12	0.12							
	Lace Bryozoans	Bryozoan 10 lace	BRY10	brb									0.12	0.12							
		Bryozoan 11 lace	BRY11	bryc									0.13	0.13							
		Bryozoan 6 lace	BRY6	br1									0.66	0.29	3.33	2.34					
		Bryozoan 7 lace	BRY7	br2									0.30	0.30							
		Bryozoan 8 lace	BRY8	br3									0.12	0.12							
	Plate Bryozoans	Bryozoan 16 plate	NB6	NA							1.20	1.20	0.39	0.23							
Bryozoans Total									*0.41*	*0.41*	*1.20*	*1.20*	*2.80*	*1.76*	*3.33*	*2.34*					

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Appendix Table 28 *continued*. Quantitative estimates of percentage cover at Munday Island T2 in 2010

Munday Island T2																					
					Depth																
					0.5m		**1m**		**2m**		**3m**		**5m**		**10m**		**15m**		**20m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Cnidarians	Bramble corals	Asperaxis kareni	ASP	brc2									0.32	0.23						
	Sea Whips	?Primnoella australasiae	SW	whi									12.46	2.54						
	Soft corals	Capnella spp. - brown	CAPB	socb					0.41	0.41	26.46	7.59								
		Clavularia spp. - white	CLAV	oc2							2.95	1.01	11.39	1.47	35.85	3.89	20.92	3.74	4.26	2.25
	Zooanthids	Parazoanthus spp.	PARA	yez									0.12	0.12						
Cnidarians Total									*0.41*	*0.41*	*29.41*	*8.59*	*24.28*	*4.36*	*35.85*	*3.89*	*20.92*	*3.74*	*4.26*	*2.25*
Echinoderms	Basket stars	Conocladus australis	BAS	bas									0.13	0.13						
	Sea Stars	Tosia magnifica	TOM	tom									0.22	0.15			0.43	0.43		
Echinoderms Total													*0.34*	*0.28*			*0.43*	*0.43*		
Other Cover	Other Cover	Algal turf	TURF	NA	0.47	0.47	1.83	1.38	46.15	12.14	3.67	2.27	0.33	0.18						
		Algal/Hydroid/Silt matrix	AHS	NA					2.86	2.00	24.38	8.23	1.00	0.64						
		Biogenic Matrix	MATR	NA			1.20	1.20	9.68	5.78	21.01	3.45	31.46	4.53	4.99	1.31	8.70	3.10	2.94	1.43
		Fine hydroid/bryozoan layer	BREB	breb					1.22	1.22	6.85	0.79	12.60	2.68	28.08	5.50	45.83	3.44	25.51	0.62
Other Cover Total					*0.47*	*0.47*	*3.03*	*2.58*	*59.91*	*21.15*	*55.92*	*14.74*	*45.39*	*8.02*	*33.07*	*6.81*	*54.54*	*6.54*	*28.46*	*2.05*
Polychaetes	Polychaetes	Galeolaria sp.	GAL	gal									0.79	0.41						
		Serpulid	SER	NA									3.12	1.12			0.43	0.43	0.40	0.40
		Terrebellid	TER	NA															0.85	0.85
Polychaetes Total													*3.92*	*1.54*			*0.43*	*0.43*	*1.25*	*1.25*
Sponges	Arborescent sponges	Arborescent sponges	-	-							1.63	1.00								
	Encrusting sponges	Encrusting sponges	-	-							1.21	0.80	1.39	0.52	0.40	0.40			1.25	1.25
	Globular sponges	Globular sponges	-	-									0.13	0.13						
	Lumpy sponges	Lumpy sponges	-	-									0.92	0.47			0.43	0.43		
	Massive sponges	Massive sponges	-	-									0.37	0.27						
	Papillate sponge	Papillate sponge	-	-					0.41	0.41			0.98	0.47	0.42	0.42				
Sponges Total									*0.41*	*0.41*	*2.84*	*1.80*	*3.78*	*1.86*	*0.82*	*0.82*	*0.43*	*0.43*	*1.25*	*1.25*
Substrate	Substrate	Gravel	GRA	gra					2.11	0.96			0.19	0.13	4.09	1.41	1.66	0.77	4.21	0.96
		Reef	BRE	bre	1.22	1.22					0.41	0.41								
		Rubble	BRUB	NA					0.44	0.44									0.82	0.50
		Sand	SAND	san					3.78	2.01	3.62	2.41	6.44	2.22	21.18	6.95	20.77	2.21	57.25	2.69
		Shells	SHELL	NA					0.41	0.41	1.22	1.22	0.29	0.29	1.27	0.86			1.27	0.84
		Silt	SILT	sed									0.29	0.16						
Substrate Total					*1.22*	*1.22*			*6.75*	*3.82*	*5.26*	*4.04*	*7.21*	*2.80*	*26.54*	*9.22*	*22.43*	*2.98*	*63.55*	*4.98*
Unscorable	Unscorable	unscorable	UNS	NA	8.80	2.73	6.00	2.97	3.60	1.60	6.00	4.52	13.81	2.54	2.40	1.60	4.00	1.26	4.40	1.33
Unscorable Total					*8.80*	*2.73*	*6.00*	*2.97*	*3.60*	*1.60*	*6.00*	*4.52*	*13.81*	*2.54*	*2.40*	*1.60*	*4.00*	*1.26*	*4.40*	*1.33*
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 29.Quantitative estimates of percentage cover at Munday Island T2 in 2002

		Depth (replicates)	0m (6)		0.5m (5)		1m (5)		2m (15)		5m (19)		10m (19)		15m (18)		20m (17)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	bro	Brown algae unidentified	4	4	0	0	0.8	0.8	0	0	0	0	0	0	0	0	0	0
	car	*Carpoglossum confluens*	19.7	16.2	59.6	14.7	8	8	0.93	0.93	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	14.4	6.31	25.6	19.4	5.87	5.32	0	0	0	0	0	0	0	0
	hor	*Hormisira banksii*	2.67	1.23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	zon	*Zonaria* spp.	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Algae-green	ulv	*Ulva* spp.	47	16	0	0	0	0	0.27	0.27	0	0	0	0	0	0	0	0
Algae-red	enc	Encrusting corralines	0	0	0	0	0	0	22.4	6.45	0	0	0	0	0	0	0	0
	tha	*Thamnoclonium dichotomum*	0	0	0	0	0	0	6	2.12	0.22	0.22	0	0	0	0	0	0
	tre	Thallose red algae	6	3.83	0	0	2	2	0	0	0	0	0	0	0	0	0	0
Total algae			80.3		74		36.4		35.5		0.22		0		0		0	
Cnidarians	oct	Common octocoral	0	0	0	0	0	0	0	0	2.67	0.94	6.89	1.41	3.78	1.6	0.35	0.26
	whi	Seawhips	0	0	0	0	0	0	0	0	5.67	1.64	0.11	0.11	0	0	0	0
	yez	Yellow zooanthid	0	0	0	0	0	0	0	0	0	0	0	0	0.44	0.35	0	0
	hyd	Hydroids	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0.33	0	0
Total cnidarians			0		0		0		0		8.33		7		4.56		0.35	
Sponges	cus	Cup sponge	0	0	0	0	0	0	0	0	0	0	1.78	0.72	0	0	0	0
	sp11	Large grey sponge, spines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.47	0.47
	sp17	Sponge massive white-grey	0	0	0	0	0	0	0	0	0	0	0	0	0.56	0.56	0	0
	sp21	Sponge pink-orange knobby	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0.33	0	0
	sp23	Sponge grey massive	0	0	0	0	0	0	0	0	0	0	0.33	0.32	0	0	0	0
	spo	Sponge u/i usually flat	0	0	0	0	0	0	1.2	0.73	6.11	1.75	2	0.63	3.22	0.61	2.71	0.66
Total sponges			0		0		0		1.2		6.11		4.11		4.11		3.18	
Bryozoans	br2	Lace bryozoan 2	0	0	0	0	0	0	0	0	0	0	0	0	1.11	0.46	0	0
	br5	Branching bryozoan 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.71	0.51
	bry	Lace bryozoan, unidentified	0	0	0	0	0	0	0	0	0.11	0.11	0.22	0.22	0	0	0.24	0.24
Total bryozoans			0		0		0		0		0.11		0.22		1.11		0.94	
Ascidians	wta	White throated ascidian	0	0	0	0	0	0	0	0	0.33	0.24	0.33	0.18	0	0	0	0
Molluscs	myt	*Mytilus edulis*	4	2.58	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echinoderms	bas	Basketstar	0	0	0	0	0	0	0	0	0.11	0.11	0	0	0	0	0	0
	gon	*Goniocidaris tubaria*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	tom	*Tosia magnifica*	0	0	0	0	0	0	0	0	0.22	0.22	0.22	0.15	0	0	0	0
Other Cover	epi	Fine hydroid/bryozoan layer	0	0	0	0	0	0	47.3	8.62	75.9	4.88	86.3	1.93	90.1	2.5	4.94	3.54
	uid	Unidentified cover	6.33	6.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Substrate	bre	Bare reef	9.33	8.94	26	15.9	63.6	17.3	63.3	6.51	75.9	4.88	86.3	1.93	90.1	2.5	41.4	8.3
	san	Sand	0	0	0	0	0	0	0	0	4.44	2.57	0	0	0	0	0	0
	sed	Sediment, usually fine	0	0	0	0	0	0	0	0	0.89	0.87	1.89	0.88	0	0	54.1	8.64
Total substrate			9.33		26		63.6		63.3		81.2		88.2		90.1		95.5	

Appendix Table 30. Quantitative estimates of percentage cover at Little Woody Island T1 in 2010

Little Woody T1																					
					Depth																
					0.5m		1m		2m		3m		5m		10m		15m		20m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Carpoglossum confluens	CAR	car	38.19	14.39			0.40	0.40	0.43	0.43								
		Ecklonia radiata	ECK	eck	40.08	15.29	94.80	2.80	87.60	12.40										
	Green algae	Algal Mat Green	AMG	NA							0.63	0.32								
		Codium pomoides	COP	cop					0.40	0.40										
		Ulva spp.	ULV	uvl	1.78	1.78														
	Red algae	encrusting coralline	ECO	enc							0.21	0.21								
		Geniculate coralline algae	GCO	gco													0.36	0.36		
		Peyssonnelia spp.	PEY	pey	1.81	1.35														
		Pollexfenia lobata	NB24	NA													0.18	0.18		
		Thamnoclonium dichotomum	THAM	tham					1.20	1.20										
	Unidentified algae	Unidentified algae	UNA	unka	0.47	0.47	0.40	0.40	0.40	0.40	0.24	0.24								
		Unidentified algae - drift	DRIFT	dri							0.65	0.33					0.20	0.20		
		Unidentified algae - erect branching	EBA	NA	12.09	12.09	4.00	2.28	0.40	0.40	0.41	0.41								
		Unidentified algae - filamentous	FIL	NA							2.80	1.31								
		Unidentified algae - foliose	FOL	NA					0.40	0.40										
Algae Total					*94.42*	*45.36*	*99.20*	*5.48*	*90.80*	*15.60*	*5.37*	*3.25*					*0.75*	*0.75*		
Ascidians	Colonial ascidians	Ascidian 10 colonial	NB58	NA													0.39	0.26		
		Ascidian 21 lumpy orange	NB17	NA							1.08	0.74					0.18	0.18		
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1											0.42	0.42	0.55	0.39		
		Ascidian 16 solitary - white-throat	AS3	wta													1.39	0.70		
		Ascidian unidentified	ASC	asc											0.82	0.82	0.57	0.40		
Ascidians Total											*1.08*	*0.74*			*1.23*	*1.23*	*3.08*	*1.94*		
Bryozoans	Branching Bryozoans	Bryozoan 13 Caberea like 2	BRY13	NA													1.17	0.67		
		Bryozoan 17 branching (cf Nevianipora spp.)	NB70	NA													0.42	0.28		
	Lace Bryozoans	Bryozoan 10 lace	BRY10	brb													0.19	0.19		
		Bryozoan 6 lace	BRY6	br1									6.61	2.39						
		Bryozoan 7 lace	BRY7	br2													0.20	0.20		
	Plate Bryozoans	Bryozoan 16 plate	NB6	NA									6.52	1.74						
Bryozoans Total													*13.13*	*4.13*			*1.99*	*1.34*		
Cnidarians	Soft corals	Capnella spp. - brown	CAPB	socb							5.41	2.64	0.42	0.42						
		Capnella spp. - yellow	CAPY	socy							40.99	3.89	2.82	2.33						
		Clavularia spp. - white	CLAV	oc2									10.30	3.89						
	Solitary coral	Solitary coral 1	COR	sco													1.48	0.56		
Cnidarians Total											*46.40*	*6.53*	*13.53*	*6.64*			*1.48*	*0.56*		

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Appendix Table 30 *continued*. Quantitative estimates of percentage cover at Little Woody Island T1 in 2010

Little Woody T1																					
					Depth																
					0.5m		**1m**		**2m**		**3m**		**5m**		**10m**		**15m**		**20m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Echinoderms	Sea Stars	Tosia magnifica	TOM	tom							0.21	0.21					0.19	0.19		
Echinoderms Total											*0.21*	*0.21*					*0.19*	*0.19*		
Other Cover	Other Cover	Algal turf	TURF	NA	2.79	1.71			3.20	3.20										
		Algal/Hydroid/Silt matrix	AHS	NA	2.33	2.33			5.20	5.20	34.45	3.75	0.80	0.80						
		Biogenic Matrix	MATR	NA	0.47	0.47	0.80	0.80	0.40	0.40	1.89	0.57	11.86	3.44	4.46	0.76	0.36	0.24		
		Bioturbation	BIOT	NA															1.60	1.17
		Fine hydroid/bryozoan layer	BREB	breb							3.11	3.11	58.23	4.14	92.29	0.79	69.70	5.08		
Other Cover Total					*5.58*	*4.50*	*0.80*	*0.80*	*8.80*	*8.80*	*39.45*	*7.43*	*70.89*	*8.37*	*96.75*	*1.55*	*70.06*	*5.32*	*1.60*	*1.17*
Polychaetes	Polychaetes	Serpulid	SER	NA											0.42	0.42	0.22	0.22		
Polychaetes Total															*0.42*	*0.42*	*0.22*	*0.22*		
Sponges	Arborescent sponges	Arborescent sponges	-	-													0.37	0.37		
	Encrusting sponges	Encrusting sponges	-	-							2.32	0.96	1.22	0.80			2.27	0.89		
	Globular sponges	Globular sponges	-	-							0.24	0.24								
	Lumpy sponges	Lumpy sponges	-	-													1.41	0.90		
	Papillate sponge	Papillate sponge	-	-									0.40	0.40						
	Tubular sponge	Tubular sponge	-	-							0.21	0.21	0.42	0.42						
Sponges Total											*2.77*	*1.41*	*2.03*	*1.62*			*4.05*	*2.16*		
Substrate	Substrate	Gravel	GRA	gra					0.40	0.40	2.07	1.11								
		Reef	BRE	bre							0.43	0.43	0.41	0.41						
		Sand	SAND	san											0.80	0.80	16.73	5.54	98.40	1.17
		Shells	SHELL	NA							2.23	1.47			0.80	0.80	0.19	0.19		
		Silt	SILT	sed													1.27	0.94		
Substrate Total									*0.40*	*0.40*	*4.73*	*3.00*	*0.41*	*0.41*	*1.60*	*1.60*	*18.19*	*6.67*	*98.40*	*1.17*
Unscorable	Unscorable	unscorable	UNS	NA	9.20	2.24	0.80	0.80	0.80	0.80	5.00	1.56	2.40	0.75	1.20	0.80	3.45	1.57		
Unscorable Total					*9.20*	*2.24*	*0.80*	*0.80*	*0.80*	*0.80*	*5.00*	*1.56*	*2.40*	*0.75*	*1.20*	*0.80*	*3.45*	*1.57*		
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 31. Quantitative estimates of percentage cover at Little Woody Island T1 in 2002

		Depth (replicates)	0m (4)		0.5m (9)		1m (2)		2m (8)		3m (6)		5m (23)		10m (19)		15m (21)		17m (9)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	car	*Carpoglossum confluens*	8	8	52.7	16.7	0	0	6	4.54	0	0	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	0	0	55	45	31.5	10.4	0	0	0	0	0	0	0	0	0	0
	hor	*Hormisira banksii*	39	21.5	26.4	9.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Algae-green	cop	*Codium pomoides*	0	0	0	0	0	0	0	0	1.33	0.99	0	0	0	0	0	0	0	0
	ulv	U*lva* spp.	48	17.2	19.8	9.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Algae-red	fre	Fillamentous reds	0	0	4	2.96	0	0	0	0	8.67	7.19	0	0	0	0	0	0	0	0
Total algae			95		103		55		37.5		10		0		0		0		0	
Cnidarians	an2	Common tube anemone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.44	2.13
	oct	Common octocoral	0	0	0	0	0	0	0	0	0	0	0	0	27.1	4.82	12.1	2.58	0	0
	sco	Solitary coral	0	0	0	0	0	0	0	0	0	0	0	0	0.11	0.11	0.4	0.18	0	0
	soc	Soft coral	0	0	0	0	0	0	0	0	6.67	6.28	29	4.68	0	0	0	0	0	0
Total cnidarians			0		0		0		0		6.67		29		27.2		12.5		4.44	
Sponges	sp3	Finger sponge 3, fine white/grey	0	0	0	0	0	0	0	0	1.33	1.33	2.43	0.69	0	0	0	0	0	0
	sp5	Finger sponge 5 fine brown *Th*?	0	0	0	0	0	0	0	0	2.67	2.67	0	0	0	0	0	0	0	0
	sp6	Tube sponge?	0	0	0	0	0	0	0	0	4.67	4.67	0	0	0	0	0	0	0	0
	spo	Sponge u/i usually flat	0	0	0	0	0	0	0	0	1.33	0.42	12	1.96	2.56	0.44	3.1	0.79	0	0
Total sponges			0		0		0		0		10		14.4		2.56		3.1		0	
Bryozoans	br2	Lace bryozoan 2	0	0	0	0	0	0	0	0	0	0	1.57	1.39	0	0	0	0	0	0
	br3	Lace bryozoan 3	0	0	0	0	0	0	0	0	0	0	0.17	0.17	0.56	0.44	0	0	0	0
	br4	Lace bryozoan 4	0	0	0	0	0	0	0	0	0	0	3.91	1.76	0	0	0	0	0	0
	brf	Lace bryozoan 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.2	0	0
	bru	Lace bryozoan, unidentified	0	0	0	0	0	0	0	0	0	0	0	0	0.11	0.11	0.1	0.1	0	0
	bryc	Lace bryozoan 8	0	0	0	0	0	0	0	0	0	0	8.7	2.35	0	0	0	0	0	0
Total bryozoans			0		0		0		0		0		14.3		0.67		0.3		0	
Ascidians	wta	White throated ascidian	0	0	0	0	0	0	0.25	0.25	0	0	0	0	1.11	0.65	0.1	0.1	0	0
Molluscs	bra	Ark shell (*Barbatia pistachia*)	0	0	0	0	0	0	0	0	0	0	0	0	0.56	0.44	0	0	0	0
	myt	*Mytilus edulis*	1.5	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echinoderms	gon	*Goniocidaris tubaria*	0	0	0	0	0	0	0	0	0	0	0	0	0.44	0.43	0	0	0	0
	toa	*Tosia australis*	0	0	0	0	0	0	0	0	0	0	0.17	0.12	0	0	0	0	0	0
Substrate	bre	Bare reef	0	0	0	0	0	0	62.3	11.4	73.3	10.6	36.5	5.09	57.7	7.06	85	2.63	95.6	2.13
	sed	Sediment, usually fine	0	0	0	0	0	0	0	0	0	0	0	0	5.56	5.41	0	0	0	0
Total substrate			0		0		0		62.3		73.3		36.5		63.2		85		95.6	

Appendix Table 32. Quantitative estimates of percentage cover at Little Woody Island T2 in 2010

Little Woody T2																			
					Depth														
					0.5m		1m		2m		3m		5m		10m		15m		
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	
Algae	Brown algae	Carpoglossum confluens	CAR	car	78.64	5.79	7.34	6.37											
		Dictyopteris muelleri	NB22	NA	5.92	2.16	3.32	2.39											
		Ecklonia radiata	ECK	eck	5.77	3.83	73.27	9.29											
	Green algae	Chaetomorpha coliformis	NB25	NA	0.43	0.43	0.41	0.41											
		Ulva spp.	ULV	uvl	0.43	0.43			0.44	0.44									
	Red algae	Foliose red algae	FORE	fore	0.42	0.42													
		Peyssonnelia spp.	PEY	pey			2.69	1.81	0.42	0.42									
		Pollexfenia lobata	NB24	NA			0.41	0.41											
		Thamnoclonium dichotomum	THAM	tham							5.76	3.88							
	Unidentified algae	Unidentified algae	UNA	unka	3.29	2.78	0.82	0.82											
		Unidentified algae - drift	DRIFT	dri					1.22	1.22			0.43	0.43					
		Unidentified algae - erect branching	EBA	NA	0.43	0.43	1.74	1.74	2.45	2.45	0.49	0.49							
		Unidentified algae - filamentous	FIL	NA					9.38	6.94	1.38	0.96							
Algae Total					*95.34*	*16.28*	*89.99*	*23.23*	*13.91*	*11.47*	*7.63*	*5.33*	*0.43*	*0.43*					
Ascidians	Colonial ascidians	Ascidian 21 lumpy orange	NB17	NA							0.42	0.42							
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1									0.43	0.43					
		Ascidian unidentified	ASC	asc					0.41	0.41									
Ascidians Total									*0.41*	*0.41*	*0.42*	*0.42*	*0.43*	*0.43*					
Bryozoans	Lace Bryozoans	Bryozoan 6 lace	BRY6	br1									1.29	0.53					
Bryozoans Total													*1.29*	*0.53*					
Cnidarians	Soft corals	Capnella spp. - brown	CAPB	socb							19.15	9.87							
		Capnella spp. - yellow	CAPY	socy					0.41	0.41	22.78	8.26	0.85	0.85					
		Clavularia spp. - white	CLAV	oc2									4.27	1.78					
Cnidarians Total									*0.41*	*0.41*	*41.93*	*18.12*	*5.12*	*2.63*					
Other Cover	Other Cover	Algal turf	TURF	NA	4.22	2.71	1.25	0.82											
		Algal/Hydroid/Silt matrix	AHS	NA			2.50	1.98	55.37	16.58	39.40	14.22	0.83	0.83					
		Biogenic Matrix	MATR	NA			5.81	2.45			5.73	2.39	0.42	0.42					
		Fine hydroid/bryozoan layer	BREB	breb					24.35	15.03	3.64	3.64	70.68	4.59	98.80	0.80			
		Fine sediment cover on bare reef	BRES	bres									0.43	0.43					
Other Cover Total					*4.22*	*2.71*	*9.56*	*5.25*	*79.72*	*31.60*	*48.77*	*20.25*	*72.36*	*6.27*	*98.80*	*0.80*			
Polychaetes	Polychaetes	Galeolaria sp.	GAL	gal					0.44	0.44									
Polychaetes Total									*0.44*	*0.44*									
Sponges	Globular sponges	Globular sponges	-	-					0.42	0.42									
	Lumpy sponges	Lumpy sponges	-	-							0.42	0.42							
	Tubular sponge	Tubular sponge	-	-							0.83	0.83							
Sponges Total									*0.42*	*0.42*	*1.25*	*1.25*							
Substrate	Substrate	Gravel	GRA	gra					2.22	2.22			0.43	0.43	1.20	0.80			
		Reef	BRE	bre	0.43	0.43			0.83	0.83									
		Sand	SAND	san					0.41	0.41			19.94	5.74			100.00		
		Shells	SHELL	NA			0.45	0.45	0.41	0.41									
		Silt	SILT	sed					0.82	0.82									
Substrate Total					*0.43*	*0.43*	*0.45*	*0.45*	*4.69*	*4.69*			*20.37*	*6.16*	*1.20*	*0.80*	*100.00*		
Unscorable	Unscorable	unscorable	UNS	NA	5.60	1.17	8.00	1.67	3.60	1.72	10.00	3.03	5.20	1.50					
Unscorable Total					*5.60*	*1.17*	*8.00*	*1.67*	*3.60*	*1.72*	*10.00*	*3.03*	*5.20*	*1.50*					
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		

Appendix Table 33. Quantitative estimates of percentage cover at Little Woody Island T2 in 2002

		Depth (replicates)	0.5m (5)		1m (1)		2m (4)		3m (2)		5m (12)		10m (14)		12m (6)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	car	*Carpoglossum confluens*	53.2	15.6	8	0	44	19.3	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	9.6	7.36	0	0	11.5	11.5	0	0	0	0	0	0	0	0
	hor	*Hormisira banksii*	10.4	4.79	0	0	0	0	0	0	0	0	0	0	0	0
Algae-green	ulv	*Ulva* spp.	22.8	12.8	52	0	0	0	0	0	0	0	0	0	0	0
Algae-red	fre	Fillamentous reds	3.6	2.23	36	0	0	0	0	0	0	0	0	0	0	0
Total algae			99.6		96		55.5		0		0		0		0	
Cnidarians	sco	Solitary coral	0	0	0	0	0	0	0	0	0	0	0.29	0.29	0	0
	soc	Soft coral	0	0	0	0	0	0	0	0	0	0	0.29	0.19	0	0
Total cnidarians			0		0		0		0		0		0.57		0	
Sponges	sp4	Finger sponge 4, Little Woody Is	0	0	0	0	0	0	0	0	0.33	0.33	0	0	0	0
	spo	Sponge u/i usually flat	0.4	0.4	0	0	0.5	0.5	1	1	0.5	0.26	1	0.46	3.67	1.96
Total sponges			0.4		0		0.5		1		0.83		1		3.67	
Bryozoans	bru	Lace bryozoan, unidentified	0	0	0	0	0	0	0	0	0.83	0.83	0	0	0	0
Ascidians	as2	Ascidian colonial stalked.	0	0	0	0	0	0	0	0	0	0	0.14	0.14	0	0
	wta	White throated ascidian	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Molluscs	myt	*Mytilus edulis*	0	0	6	0	0	0	0	0	0	0	0	0	0	0
	tom	*Tosia magnifica*	0	0	0	0	0	0	0	0	0	0	0.43	0.31	0	0
Other Cover	epi	Fine hydroid/bryozoan layer	0	0	0	0	5	5	0	0	0	0	0	0	0	0
Substrate	bre	Bare reef	2.4	2.4	0	0	39	42.9	98	2	15.3	8.18	0	0	13.7	7.7
	sed	Sediment, usually fine	0	0	0	0	0	0	0	0	83	8.98	98.3	0.46	74.3	11
	uic	Unidentified cover	0.4	0.4	0	0	0	0	0	0	0	0	0	0	0	0
Total substrate			2.8		0		39		98		98.3		98.3		88	

Appendix Table 34. Quantitative estimates of percentage cover at Little Woody Island T3 in 2010

Little Woody T3																	
					Depth												
					0.5m		1m		2m		3m		5m		10m		13.7m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Carpoglossum confluens	CAR	car	54.10	4.82	0.80	0.49	1.60	1.60								
		Dictyopteris muelleri	NB22	NA	2.40	1.60												
		Ecklonia radiata	ECK	eck			33.42	16.94										
	Green algae	Algal Mat Green	AMG	NA							0.40	0.40	0.41	0.41				
		Ulva spp.	ULV	uvl			0.40	0.40										
	Red algae	Foliose red algae	FORE	fore	0.80	0.80												
		Peyssonnelia spp.	PEY	pey			1.20	1.20										
		Pollexfenia lobata	NB24	NA	0.40	0.40												
	Unidentified algae	Unidentified algae - drift	DRIFT	dri			0.80	0.80	16.34	8.26								
		Unidentified algae - filamentous	FIL	NA	29.82	2.49												
Algae Total					*87.52*	*10.11*	*36.62*	*19.83*	*17.94*	*9.86*	*0.40*	*0.40*	*0.41*	*0.41*				
Ascidians	Colonial ascidians	Ascidian 20 lumpy yellow	NB16	NA									6.37	5.87				
		Ascidian 21 lumpy orange	NB17	NA							0.85	0.85						
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1											0.40	0.40		
		Ascidian 16 solitary - white-throat	AS3	wta			1.20	1.20										
		Sycozoa pulchra	NB7	NA											0.40	0.40		
Ascidians Total							*1.20*	*1.20*			*0.85*	*0.85*	*6.37*	*5.87*	*0.80*	*0.80*		
Bryozoans	Branching Bryozoans	Bryozoan 14 branching (orange flat)	NB11	NA									8.30	1.44				
	Encrusting Bryozoans	Bryozoan 15 encrusting	NB21	NA									0.41	0.41				
	Lace Bryozoans	Bryozoan 10 lace	BRY10	brb											0.40	0.40		
		Bryozoan 7 lace	BRY7	br2									1.28	1.28				
	Plate Bryozoans	Bryozoan 16 plate	NB6	NA							2.55	2.55	0.41	0.41	0.40	0.40		
Bryozoans Total											*2.55*	*2.55*	*10.39*	*3.53*	*0.80*	*0.80*		
Cnidarians	Anemone	Anemone 2 – common tube	AN2	an2											0.40	0.40		
	Soft corals	Capnella spp. - brown	CAPB	socb							2.10	1.65	4.68	3.71				
		Capnella spp. - yellow	CAPY	socy					7.60	4.66	3.33	0.52	2.87	2.00				
Cnidarians Total									*7.60*	*4.66*	*5.43*	*2.17*	*7.56*	*5.71*	*0.40*	*0.40*		
Crustacea	Shrimp	Palaemon serenus	NB20	NA					0.81	0.49								
Crustacea Total									*0.81*	*0.49*								
Echinoderms	Sea Stars	Tosia magnifica	TOM	tom									0.42	0.42	0.40	0.40		
Echinoderms Total													*0.42*	*0.42*	*0.40*	*0.40*		
Fish	Fish	Fish unidentified	FISH	NA													0.40	0.40
Fish Total																	*0.40*	*0.40*

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Appendix Table 34*continued*. Quantitative estimates of percentage cover at Little Woody Island T3 in 2010

Little Woody T3																	
					Depth												
					0.5m		**1m**		**2m**		**3m**		**5m**		**10m**		**13.7m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Other Cover	Other Cover	Algal/Hydroid/Silt matrix	AHS	NA	8.47	2.31	39.38	10.00	37.13	17.26					0.40	0.40		
		Biogenic Matrix	MATR	NA	0.42	0.42					1.63	1.17			0.40	0.40		
		Bioturbation	BIOT	NA											0.40	0.40	3.60	1.17
		Fine hydroid/bryozoan layer	BREB	breb			7.60	7.60	26.40	15.77	26.03	8.42	61.61	5.45	20.40	16.50		
		Fine sediment cover on bare reef	BRES	bres			1.20	1.20	0.85	0.85								
Other Cover Total					*8.88*	*2.73*	*48.18*	*18.80*	*64.38*	*33.88*	*27.65*	*9.59*	*61.61*	*5.45*	*21.60*	*17.70*	*3.60*	*1.17*
Polychaetes	Polychaetes	Terrebellid	TER	NA											0.40	0.40		
Polychaetes Total															*0.40*	*0.40*		
Sponges	Arborescent sponges	Arborescent sponges	-	-							11.63	2.61	1.26	0.85				
	Encrusting sponges	Encrusting sponges	-	-					1.20	0.80			4.12	1.82	1.60	1.60		
	Lumpy sponges	Lumpy sponges	-	-									3.36	1.72	0.40	0.40		
	Papillate sponge	Papillate sponge	-	-									1.23	0.82				
	Tubular sponge	Tubular sponge	-	-							0.43	0.43	1.65	1.01	0.40	0.40		
Sponges Total									*1.20*	*0.80*	*12.06*	*3.03*	*11.62*	*6.21*	*2.40*	*2.40*		
Substrate	Substrate	Gravel	GRA	gra			1.60	1.60			1.20	1.20						
		Reef	BRE	bre	3.60	1.72	3.20	0.80	1.20	1.20								
		Rubble	BRUB	NA							0.40	0.40			2.80	1.74		
		Sand	SAND	san							0.85	0.85			2.00	2.00		
		Shells	SHELL	NA			4.40	4.40										
		Silt	SILT	sed			4.80	4.80	6.87	3.88	48.60	9.45	1.63	1.63	68.40	18.06	96.00	1.41
Substrate Total					*3.60*	*1.72*	*14.00*	*11.60*	*8.07*	*5.08*	*51.06*	*11.91*	*1.63*	*1.63*	*73.20*	*21.80*	*96.00*	*1.41*
Unscorable	Unscorable	unscorable	UNS	NA	0.80	0.80	1.20	1.20	1.60	1.17	3.60	1.47	4.00	0.89				
Unscorable Total					*0.80*	*0.80*	*1.20*	*1.20*	*1.60*	*1.17*	*3.60*	*1.47*	*4.00*	*0.89*				
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 35. Quantitative estimates of percentage cover at Little Woody Island T3 in 2002

		Depth (replicates)	0m (4)		1m (5)		2m (14)		5m (17)		7m (12)		8m (13)		10m (4)		12m (1)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	alg	Unidentified algae	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	car	*Carpoglossum confluens*	20	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	80	20	8.57	7.1	0	0	0	0	0	0	0	0	0	0
	hor	*Hormisira banksii*	23	9.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Algae-green	ulv	Ulva spp.	41	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Algae-red	enc	Encrusting corralines	0	0	0	0	2.71	2.56	0	0	0	0	0	0	0	0	0	0
	fre	Fillamentous reds	7.5	4.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	tha	*Thamnoclonium dichotomum*	0	0	0	0	12.1	6.81	9.76	3.54	0	0	0	0	0	0	0	0
Total algae			93		80		23.4		9.76		0		0		0		0	
Cnidarians	oct	Common octocoral	0	0	0	0	0	0	0.59	0.59	2	1.54	2.31	1.39	0	0	0	0
	an1	Anemone, pink solitary	0	0	0	0	0	0	0	0	0.3	0.33	0	0	0	0	0	0
	sco	Solitary coral	0	0	0	0	0	0	0	0	0.3	0.33	0	0	0	0	0	0
	soc	Soft coral	0	0	0	0	2.14	1.28	14.2	3.82	0.5	0.36	0.15	0.15	0	0	0	0
Total cnidarians			0	0		0		2.14		14.8		3.2		2.46		0		0
Sponges	fsbc	Finger sponge broad cream	0	0	0	0	0	0	0.24	0.24	0	0	0	0	0	0	0	0
	fso	Finger sponge-orange	0	0	0	0	0	0	8.24	2.26	0	0	0	0	0	0	0	0
	fsw	Finger sponge-white,cf orange	0	0	0	0	0	0	0.71	0.71	0.2	0.17	0	0	0	0	0	0
	jhs	Jokers hat sponge	0	0	0	0	0	0	2.47	0.9	0.8	0.46	0.15	0.15	0	0	0	0
	sp2	Sponge finger, very fine white/grey	0	0	0	0	0	0	1.88	1.29	0	0	0	0	0	0	0	0
	spo	Sponge u/i usually flat	0	0	0.8	0.8	1.29	0.4	4.35	0.99	3.7	0.81	4.77	1.1	0	0	0	0
	ssg	Sponge solid grey	0	0	0	0	0	0	0.59	0.41	0	0	0	0	0	0	0	0
Total sponges			0	0		0.8		1.29		18.5		4.7		4.92		0		0
Bryozoans	br4	Lace bryozoan 4	0	0	0	0	0	0	0.82	0.57	0	0	0	0	0	0	0	0
	brb	Lace bryozoan 7	0	0	0	0	0	0	0	0	0.2	0.17	0	0	0	0	0	0
	brf	Lace bryozoan 5	0	0	0	0	0	0	0.94	0.67	0	0	0	0	0	0	0	0
	bry	Lace bryozoan, unidentified	0	0	0	0	0	0	0.94	0.52	3.2	2.01	1.08	0.66	0	0	0	0
Total bryozoans			0	0		0		0		2.71		3.3		1.08		0		0
Ascidians	asc	Ascidian u/I	0	0	0	0	0	0	0	0	1.5	1.5	0	0	0	0	0	0
	wta	White throated ascidian	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Molluscs	myt	*Mytilus edulis*	0	0	0	0	0	0	0	0	2.2	1	2.46	1.14	0	0	0	0
Annelids	gal	*Galiolaria* sp.	3.5	3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echinoderms	gon	*Goniocidaris tubaria*	0	0	0	0	1.43	1.43	0	0	0	0	0.31	0.31	0	0	0	0
	tom	*Tosia magnifica*	0	0	0	0	0	0	0.12	0.12	0.2	0.17	0	0	0	0	0	0
Other Cover	bres	Fine sediment cover on bare reef	0	0	0	0	0	0	0.12	0.12	0.2	0.17	0.31	0.31	1	1	0	0
	epi	Fine hydroid/bryozoan layer	0	0	0	0	48.9	12.3	2.71	2.71	19	10.1	0	0	0	0	0	0
	uic	Unidentified cover	0	0	20	20	0	0	48.8	5.98	33	12.6	92.2	7.35	0	0	0	0
Substrate	bre	Bare reef	0	0	0	0	0	0	4.35	3.08	0	0	0	0	0	0	0	0
	sed	Sediment, usually fine	0	0	20	20	90.1	14.8	51.9	4.47	54	11.6	92.2	7.35	0	0	0	0
	sgr	Sand/gravel	0	0	0	0	3.86	3.86	0	0	26	11.5	4	3.14	99	1	0	0
Total substrate			0		20		94		56.2		79		96.2		99		0	

Appendix Table 36. Quantitative estimates of percentage cover at Joan Point T1 in 2010

Joan Point T1																					
					Depth																
					0-0.5m		0.5m		1m		2m		3m		5m		10m		15m		20m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Carpoglossum confluens	CAR	car	2.80	2.80	76.05	13.64			2.11	1.65										
		Dictyopteris muelleri	NB22	NA							24.35	11.25										
		Ecklonia radiata	ECK	eck			0.43	0.43	98.40	0.98												
		Hormisira banksii	HOR	hor	59.86	6.13																
	Green algae	Chaetomorpha coliformis	NB25	NA	9.27	3.47	13.60	9.74														
		Codium spp.	COD	cos	1.60	1.17																
		Filamentous green algae	FILG	filg			4.43	2.31														
		Ulva spp.	ULV	uvl	16.43	6.10	4.28	3.31			2.08	1.17			0.40	0.40						
	Red algae	Foliose red algae	FORE	fore			0.40	0.40			4.07	2.14										
		Pollexfenia lobata	NB24	NA							4.00	2.53										
	Unidentified algae	Unidentified algae	UNA	unka	0.41	0.41					0.82	0.82										
		Unidentified algae - drift	DRIFT	dri							2.04	0.90	0.83	0.51	2.00	1.10						
		Unidentified algae - erect branching	EBA	NA	0.40	0.40					27.50	13.08	0.43	0.43	0.40	0.40						
Algae Total					*90.77*	*20.48*	*99.20*	*29.83*	*98.40*	*0.98*	*66.97*	*33.53*	*1.26*	*0.94*	*2.80*	*1.90*						
Ascidians	Colonial ascidians	Ascidian 2 colonial	NB26	NA									0.43	0.43								
		Ascidian 5 colonial	NB33	NA																	0.87	0.87
	Encrusting ascidians	Ascidian 13 encrusting	NB32	NA																	0.82	0.82
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1													1.60	0.75	0.81	0.49		
		Ascidian 16 solitary - white-throat	AS3	wta							0.41	0.41										
		Ascidian unidentified	ASC	asc													0.80	0.49				
		Herdmania grandis	AS2	rta							0.40	0.40										
Ascidians Total											*0.81*	*0.81*	*0.43*	*0.43*			*2.40*	*1.24*	*0.81*	*0.49*	*1.69*	*1.69*
Bivalves	Mussels bivalve	Mytilus edulis	MYT	myt	1.20	1.20																
Bivalves Total					*1.20*	*1.20*																
Bryozoans	Branching Bryozoans	Adeonellopsis parvipuncta	BRY5	br7													0.80	0.80				
		Bryozoan 12 Caberea like	BRY12	NA											0.40	0.40			0.40	0.40		
		Bryozoan 13 Caberea like 2	BRY13	NA									1.68	1.03								
		Bryozoan 17 branching (cf Nevianipora spp.)	NB70	NA													0.40	0.40				
		Hornea robusta	BRY3	br5													0.40	0.40				
	Lace Bryozoans	Bryozoan 6 lace	BRY6	br1											0.40	0.40						
Bryozoans Total													*1.68*	*1.03*	*0.80*	*0.80*	*1.60*	*1.60*	*0.40*	*0.40*		
Cnidarians	Anemone	Anenome 1 - pink solitary	AN1	an1																	4.92	4.40
	Bramble corals	Asperaxis kareni	ASP	brc2																	0.43	0.43
	Hydroids	Hydroid 1	HYD1	hyd							0.41	0.41										
	Soft corals	Capnella spp. - brown	CAPB	socb									9.93	3.39	0.40	0.40						
		Capnella spp. - yellow	CAPY	socy							7.22	6.72	38.35	4.06	2.80	1.96	0.40	0.40	1.63	0.76		
		Clavularia spp. - white	CLAV	oc2											1.20	1.20	2.40	1.94	0.81	0.49		
	Zooanthids	Parazoanthus spp.	PARA	yez																	24.73	14.82
Cnidarians Total											*7.62*	*7.13*	*48.28*	*7.45*	*4.40*	*3.56*	*2.80*	*2.34*	*2.44*	*1.26*	*30.09*	*19.66*
Crustacea	Shrimp	Palaemon serenus	NB20	NA																	0.43	0.43
Crustacea Total																					*0.43*	*0.43*
Echinoderms	Sea Stars	Tosia australis	TOA	toa							0.40	0.40										
	Urchins	Goniocidaris tubaria	GON	gon											0.80	0.49						
Echinoderms Total											*0.40*	*0.40*			*0.80*	*0.49*						

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Appendix Table 36 *continued*. Quantitative estimates of percentage cover at Joan Point T1 in 2010

Joan Point T1 *continued*																					
					Depth																
					0-0.5m		**0.5m**		**1m**		**2m**		**3m**		**5m**		**10m**		**15m**		**20m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Other Cover	Other Cover	Algal turf	TURF	NA	1.61	1.17																
		Algal/Hydroid/Silt matrix	AHS	NA							11.85	2.72	16.46	6.96								
		Biogenic Matrix	MATR	NA	0.40	0.40							3.71	2.29	1.20	0.80	1.20	1.20	12.04	6.95	17.98	5.41
		Fine hydroid/bryozoan layer	BREB	breb									10.65	6.02	74.00	7.18	59.20	7.34	57.21	12.10	35.94	8.79
		Fine sediment cover on bare reef	BRES	bres											2.40	1.47						
Other Cover Total					*2.01*	*1.57*					*11.85*	*2.72*	*30.81*	*15.27*	*77.60*	*9.45*	*60.40*	*8.54*	*69.25*	*19.06*	*53.91*	*14.20*
Polychaetes	Polychaetes	Galeolaria sp.	GAL	gal									0.41	0.41					0.41	0.41		
		Serpulid	SER	NA									0.41	0.41			0.40	0.40			0.40	0.40
Polychaetes Total													*0.82*	*0.82*			*0.40*	*0.40*	*0.41*	*0.41*	*0.40*	*0.40*
Sponges	Arborescent sponges	Arborescent sponges	-	-							1.70	1.70										
	Encrusting sponges	Encrusting sponges	-	-													0.80	0.49	6.82	4.45	5.37	3.10
	Globular sponges	Globular sponges	-	-									3.74	1.03								
	Lumpy sponges	Lumpy sponges	-	-									1.23	0.82							2.86	1.03
	Papillate sponge	Papillate sponge	-	-									0.42	0.42								
	Tubular sponge	Tubular sponge	-	-									0.43	0.43							0.41	0.41
Sponges Total											*1.70*	*1.70*	*5.82*	*2.69*			*0.80*	*0.49*	*6.82*	*4.45*	*8.64*	*4.54*
Substrate	Substrate	Gravel	GRA	gra									2.47	1.64	0.40	0.40	0.40	0.40	3.27	2.78	4.40	4.40
		Reef	BRE	bre	6.02	1.10	0.80	0.80	1.60	0.98	1.20	1.20			2.40	1.60			0.41	0.41		
		Rubble	BRUB	NA											0.40	0.40					0.43	0.43
		Sand	SAND	san							9.44	3.97	3.33	2.34	7.60	2.86	30.00	8.56	15.40	9.16		
		Shells	SHELL	NA											2.80	1.74	1.20	0.80	0.41	0.41		
		Silt	SILT	sed									5.11	5.11					0.40	0.40		
Substrate Total					*6.02*	*1.10*	*0.80*	*0.80*	*1.60*	*0.98*	*10.64*	*5.17*	*10.91*	*9.08*	*13.60*	*7.00*	*31.60*	*9.76*	*19.88*	*13.16*	*4.83*	*4.83*
Unscorable	Unscorable	unscorable	UNS	NA	0.40	0.40	1.60	1.60			2.00	1.10	4.00	0.89					1.20	0.49	3.60	1.83
Unscorable Total					*0.40*	*0.40*	*1.60*	*1.60*			*2.00*	*1.10*	*4.00*	*0.89*					*1.20*	*0.49*	*3.60*	*1.83*
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 37. Quantitative estimates of percentage cover at Joan Point T1 in 2002

		Depth (replicates)	2m (8)		5m (17)		10m (13)		15m (16)		20m (17)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	eck	*Ecklonia radiata*	16	8.54	0	0	0	0	0	0	0	0
Cnidarians	oct	Common octocoral	0	0	0	0	12.3	4.13	0.38	0.38	1.41	1.41
	an1	Anemone, pink solitary	0	0	0	0	5.23	4.46	2.75	1.63	0	0
	an3	Anemone, elongate pink-white	0	0	0	0	0	0	0	0	8.94	4.82
	sco	Solitary coral	0	0	0	0	0	0	0	0	0.35	0.19
	soc	Soft coral	0	0	49.4	4.53	1.54	1.22	2.25	1.24	1.18	0.69
	yez	Yellow zooanthid	0	0	0	0	0	0	4.13	2.33	0	0
Total cnidarians			0		49.4		19.1		9.5		11.9	
Sponges	cus	Cup sponge	0	0	0.59	0.59	0	0	3.63	1.25	1.18	0.96
	cus2	Cup sponge. Spiral form.	0	0	0	0	0	0	0.25	0.25	0	0
	fso	Finger sponge-orange	0	0	5.65	2.39	0	0	3.25	2.07	0	0
	sp12	Sponge, large grey	0	0	0	0	0	0	2.38	1.31	1.88	1.33
	sp13	Finger sponge, slender white	0	0	0	0	0	0	0	0	0.94	0.94
	spo	Sponge u/i usually flat	0	0	1.06	0.46	1.23	1.08	16.8	3.86	11.1	3.03
Total sponges			0		7.29		1.23		26.3		15.1	
Bryozoans	br6	Branching bryozoan 2	0	0	0	0	0	0	0	0	0	0
	brf	Lace bryozoan 5	0	0	0	0	0	0	0	0	1.65	1.42
	bryc	Lace bryozoan 8	0	0	0	0	0	0	0	0	1.29	1.29
Total bryozoans			0		0		0		0		2.94	
Annelids	gal	Galiolaria sp.	0	0	0	0	0	0	1.13	0.77	0	0
Echinoderms	bas	Basketstar	0	0	0	0	0	0	0	0	0.12	0.12
	gon	*Goniocidaris tubaria*	0	0	0	0	0	0	0.13	0.13	0.12	0.12
	hel	*Heliocidaris erytrogramma*	0	0	0	0	3.38	1.95	0	0	0	0
	tom	*Tosia magnifica*	0	0	0	0	0	0	0.13	0.13	0.12	0.12
Other Cover	breb	Fine hydroid/bryozoan layer	0	0	44.5	4.64	64.8	7.63	59.9	5.26	65.8	6.63
	uic	Unidentified cover	0	0	0	0	0	0	2.5	2.5	0	0
Substrate	bre	Bare reef	84	8.54	44.5	4.64	64.8	7.63	59.9	5.26	65.8	6.63
	cob	Cobble	0	0	0	0	0.31	0.31	0	0	0	0
	sed	Sediment, usually fine	0	0	0	0	2.62	1.94	0	0	0	0
	sgr	Sand/gravel	0	0	0	0	9.08	4.54	0	0	0	0
Total substrate			84		44.5		76.8		59.9		65.8	

Appendix Table 38. Quantitative estimates of percentage cover at Joan Point T2 in 2010

Joan Point T2																					
					Depth																
					0.5m		1m		2m		3m		5m		10m		15m		20m		
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	
Algae	Brown algae	Carpoglossum confluens	CAR	car	46.09	17.99	0.40	0.40													
		Ecklonia radiata	ECK	eck	5.16	5.16	92.40	6.62	2.40	2.40											
		Hormisira banksii	HOR	hor	4.95	3.14															
		Sargassum sp.	SAR	Sar					23.52	7.84											
	Green algae	Algal Mat Green	AMG	NA							0.82	0.82									
		Chaetomorpha coliformis	NB25	NA	14.47	8.89															
		Filamentous green algae	FILG	filg			2.40	2.40													
		Ulva spp.	ULV	uvl	23.49	8.66	1.20	1.20													
	Red algae	encrusting coralline	ECO	enc							1.20	1.20									
		Foliose red algae	FORE	fore	0.65	0.65			0.41	0.41	1.20	1.20									
		Peyssonnelia spp.	PEY	pey					11.28	3.98	0.41	0.41									
		Pollexfenia lobata	NB24	NA			0.40	0.40	6.46	1.95	0.41	0.41									
	Unidentified algae	Unidentified algae - erect branching	EBA	NA	3.49	2.17			6.42	2.92	2.01	1.55									
		Unidentified algae - filamentous	FIL	NA	1.70	0.71	2.00	2.00	3.21	1.62											
		Unidentified algae - foliose	FOL	NA					8.85	3.71											
Algae Total					*100.00*	*47.37*	*98.80*	*13.02*	*62.54*	*24.83*	*6.04*	*5.58*									
Ascidians	Colonial ascidians	Ascidian 2 colonial	NB26	NA									0.40	0.40							
		Ascidian 20 lumpy yellow	NB16	NA									0.40	0.40							
	Encrusting ascidians	Ascidian 13 encrusting	NB32	NA															0.40	0.40	
	Solitary ascidians	Herdmania grandis	AS2	rta			0.40	0.40	0.41	0.41											
Ascidians Total							*0.40*	*0.40*	*0.41*	*0.41*			*0.80*	*0.80*					*0.40*	*0.40*	
Bryozoans	Branching Bryozoans	Adeonellopsis parvipuncta	BRY5	br7															0.40	0.40	
		Bryozoan 12 Caberea like	BRY12	NA															0.40	0.40	
	Lace Bryozoans	Bryozoan 10 lace	BRY10	brb									8.20	4.70							
Bryozoans Total													*8.20*	*4.70*					*0.80*	*0.80*	
Cnidarians	Hydroids	Hydroid 1	HYD1	hyd									28.38	14.97							
	Soft corals	Capnella spp. - brown	CAPB	socb							3.21	2.73	0.40	0.40							
		Capnella spp. - yellow	CAPY	socy					0.80	0.80	72.47	5.79	0.40	0.40							
		Clavularia spp. - white	CLAV	oc2									2.10	1.65							
Cnidarians Total									*0.80*	*0.80*	*75.68*	*8.51*	*31.29*	*17.41*							
Other Cover	Other Cover	Algal/Hydroid/Silt matrix	AHS	NA					10.07	3.22	2.44	1.50									
		Biogenic Matrix	MATR	NA			0.80	0.49	14.16	6.23	11.00	5.19	6.54	2.33					0.40	0.40	
		Fine hydroid/bryozoan layer	BREB	breb					0.41	0.41	0.80	0.80	51.14	10.02					11.20	6.71	
Other Cover Total							*0.80*	*0.49*	*24.64*	*9.86*	*14.24*	*7.49*	*57.68*	*12.34*					*11.60*	*7.11*	
Sponges	Encrusting sponges	Encrusting sponges	-	-									0.40	0.40					0.40	0.40	
	Globular sponges	Globular sponges	-	-							0.40	0.40									
	Lumpy sponges	Lumpy sponges	-	-							0.41	0.41	0.83	0.51					1.60	1.60	
Sponges Total											*0.81*	*0.81*	*1.23*	*0.91*					*2.00*	*2.00*	
Substrate	Substrate	Cobble	COB	cob															2.00	2.00	
		Gravel	GRA	gra					2.80	1.74			0.40	0.40	99.59	0.41			1.60	1.60	
		Reef	BRE	bre					4.02	2.61	2.42	1.48							2.40	1.47	
		Rubble	BRUB	NA									0.40	0.40							
		Sand	SAND	san					3.20	3.20	0.41	0.41			0.41	0.41	98.00	1.26	79.20	11.00	
		Shells	SHELL	NA					1.60	1.60	0.40	0.40					2.00	1.26			
Substrate Total									*11.62*	*9.15*	*3.23*	*2.29*	*0.80*	*0.80*	*100.00*	*0.82*	*100.00*	*2.53*	*85.20*	*16.07*	
Unscorable			UNS	NA	27.60	3.76			0.80	0.49	1.20	0.49	2.00	1.26	0.40	0.40					
Unscorable Total					*27.60*	*3.76*			*0.80*	*0.49*	*1.20*	*0.49*	*2.00*	*1.26*	*0.40*	*0.40*					
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		*100*		

Appendix Table 39. Quantitative estimates of percentage cover at Joan Point T2 in 2002

		Depth (replicates)	0m (5)		1m (10)		2m (15)		5m (15)		10m (9)		19m (10)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	eck	*Ecklonia radiata*	0	0	0	0	4.13	3.17	0	0	0	0	0	0
	hor	*Hormisira banksii*	81.2	8.48	0	0	0	0	0	0	0	0	0	0
Algae-green	fgr	Fillamentous greens	0	0	0	0	0.27	0.27	0	0	0	0	0	0
	ulv	*Ulva* sp.	8.8	5.16	0	0	0	0	0	0	0	0	0	0
Algae-red	enc	Encrusting corralines	0	0	0	0	0	0	0.4	0.4	0	0	0	0
	fre	Fillamentous reds	0	0	0	0	0.67	0.67	0	0	0	0	0	0
Total algae			90	0	0	0	0	0	0.4	0	0	0	0	0
Cnidarians	soc	Soft coral	0		0		0		28.5		0		0	
Sponges	sp1	Sponge 1 Joan Pt 15m.	0	0	0	0	0.67	0.67	0	0	0	0	0	0
	spo	Sponge u/i usually flat	0	0	0.8	0.44	4.13	1	3.2	1.12	0	0	0.2	0.2
Total sponges			0		0.8		0		3.2		0		0.2	
Molluscs	myt	*Mytilus edulis*	1.2	0.8	0	0	0.13	0.13	0	0	0	0	0	0
Annelids	gal	*Galiolaria* sp.	0	0	0.2	0.2	0	0	0.13	0.13	0	0	1.4	0.67
Substrate	bre	Bare reef	0	0	99.4	0.43	89.7	3.06	55.5	5.12	0	0	34.2	13.9
	gra	Gravel	0	0	0	0	0	0	1.6	1.6	0	0	0	0
	grs	Gravel with shells	0	0	0	0	0	0	8.8	4.37	100	0	64.2	14.1
	san	Sand	0	0	0	0	0	0	2.4	2.01	0	0	0	0
	sas	Sand/shells	0	0	0	0	0.93	0.93	0	0	0	0	0	0
Total bare substrate			0		99.4		90.6		68.3		100		98.4	

Appendix Table 40. Quantitative estimates of percentage cover at Joan Point T3 in 2010

Joan Point T3																	
					Depth												
					0.5m		1m		2m		5m		10m		15m		20m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Carpoglossum confluens	CAR	car	61.56	9.20	1.20	0.80										
		Dictyopteris muelleri	NB22	NA			1.20	1.20										
		Ecklonia radiata	ECK	eck			76.00	8.41										
		Hormisira banksii	HOR	hor	2.38	2.38												
	Green algae	Chaetomorpha coliformis	NB25	NA	10.56	7.78												
		Codium spp.	COD	cos	5.48	3.11												
		Ulva spp.	ULV	uvl	17.01	4.18												
	Red algae	Foliose red algae	FORE	fore			0.40	0.40										
		Phacelocarpus pepperocarpos	PHA	pha					8.40	4.49								
		Pollexfenia lobata	NB24	NA			0.40	0.40										
	Unidentified algae	Unidentified algae - erect branching	EBA	NA			0.80	0.80	3.20	2.06								
		Unidentified algae - filamentous	FIL	NA			0.80	0.80										
		Unidentified algae - foliose	FOL	NA			0.40	0.40									0.40	0.40
Algae Total					*96.99*	*26.66*	*81.20*	*13.21*	*11.60*	*6.55*							*0.40*	*0.40*
Ascidians	Colonial ascidians	Ascidian 2 colonial	NB26	NA	0.50	0.50			0.40	0.40								
		Ascidian 21 lumpy orange	NB17	NA					2.80	0.49								
	Solitary ascidians	Ascidian unidentified	ASC	asc					0.40	0.40								
Ascidians Total					*0.50*	*0.50*			*3.60*	*1.29*								
Crustacea		Barnacle	BAR	bra					*0.40*	*0.40*								
Crustacea total									0.40	0.40								
Bivalves	Nudibranchs	Phyllodesmium serratum - light pink	NUD2	NA											0.40	0.40		
Bivalves Total															*0.40*	*0.40*		
Bryozoans	Branching Bryozoans	Adeonellopsis parvipuncta	BRY5	br7											0.45	0.45		
		Bryozoan 13 Caberea like 2	BRY13	NA							0.40	0.40	0.40	0.40				
	Lace Bryozoans	Bryozoan 10 lace	BRY10	brb									0.40	0.40				
	Plate Bryozoans	Bryozoan 16 plate	NB6	NA									0.40	0.40				
Bryozoans Total											*0.40*	*0.40*	*1.20*	*1.20*	*0.45*	*0.45*		
Cnidarians	Anemone	Anenome 1 - pink solitary	AN1	an1									8.00	5.33	0.80	0.80	0.40	0.40
	Bramble corals	Acabaria sp. (orange)	ACA	brc											2.73	2.73		
		Asperaxis kareni	ASP	brc2									0.40	0.40				
	Hydroids	Hydroid 1	HYD1	hyd									0.40	0.40				
		Hydroid 2 cf Nemertensia procumbens	HYD2	hyd											1.31	0.86		
	Soft corals	Capnella spp. - brown	CAPB	socb					0.40	0.40	0.40	0.40			0.40	0.40		
		Capnella spp. - yellow	CAPY	socy					22.80	10.05	0.80	0.49	12.88	1.82	5.76	3.73	13.08	6.01
		Clavularia spp. - white	CLAV	oc2							10.00	4.77	12.02	10.14	11.28	6.95	5.60	2.40
	Solitary coral	Solitary coral 1	COR	sco													0.82	0.50
Cnidarians Total									*23.20*	*10.45*	*11.20*	*5.66*	*33.70*	*18.09*	*22.28*	*15.46*	*19.90*	*9.31*

Appendix Table 40 *continued*. Quantitative estimates of percentage cover at Joan Point T3 in 2010

Joan Point T3																	
					Depth												
					0.5m		**1m**		**2m**		**5m**		**10m**		**15m**		**20m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Echinoderms	Sea Stars	Tosia magnifica	TOM	tom											0.80	0.49		
	Urchins	Goniocidaris tubaria	GON	gon											0.88	0.54		
Echinoderms Total															*1.68*	*1.03*		
Other Cover	Other Cover	Algal/Hydroid/Silt matrix	AHS	NA					7.60	4.31								
		Biogenic Matrix	MATR	NA			8.40	3.82	0.40	0.40			0.40	0.40	5.39	1.35	2.80	1.02
		Fine hydroid/bryozoan layer	BREB	breb					36.80	6.25	48.40	10.38	51.10	3.65	43.86	4.60	57.27	8.02
Other Cover Total							*8.40*	*3.82*	*44.80*	*10.96*	*48.40*	*10.38*	*51.50*	*4.05*	*49.25*	*5.95*	*60.07*	*9.04*
Polychaetes	Polychaetes	Galeolaria sp.	GAL	gal											0.45	0.45		
Polychaetes Total															*0.45*	*0.45*		
Sponges	Arborescent sponges	Arborescent sponges	-	-					11.20	6.47							0.40	0.40
	Cup sponges	Cup sponges	-	-											4.43	1.93	0.40	0.40
	Encrusting sponges	Encrusting sponges	-	-							0.40	0.40	4.40	3.12	0.43	0.43	2.40	0.75
	Globular sponges	Globular sponges	-	-	0.50	0.50			1.60	1.17								
	Lumpy sponges	Lumpy sponges	-	-	1.50	1.50									1.25	0.51	1.60	0.98
	Massive sponges	Massive sponges	-	-													0.83	0.83
Sponges Total					*2.00*	*2.00*			*12.80*	*7.63*	*0.40*	*0.40*	*4.40*	*3.12*	*6.11*	*2.87*	*5.63*	*3.36*
Substrate	Substrate	Gravel	GRA	gra					2.80	1.96	35.20	13.14	4.80	4.32	14.18	5.02	2.80	1.20
		Reef	BRE	bre	0.51	0.51	10.40	3.19									0.40	0.40
		Rubble	BRUB	NA									0.40	0.40				
		Sand	SAND	san					0.80	0.80	4.40	3.49	4.00	3.10	2.40	1.60	10.80	5.20
		Silt	SILT	sed											2.80	1.96		
Substrate Total					*0.51*	*0.51*	*10.40*	*3.19*	*3.60*	*2.76*	*39.60*	*16.63*	*9.20*	*7.82*	*19.38*	*8.58*	*14.00*	*6.80*
Unscorable	Unscorable	unscorable	UNS	NA	17.20	1.74	1.60	1.60					0.80	0.80	3.60	2.40	0.80	0.80
Unscorable Total					*17.20*	*1.74*	*1.60*	*1.60*					*0.80*	*0.80*	*3.60*	*2.40*	*0.80*	*0.80*
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 41. Quantitative estimates of percentage cover at Joan Point T3 in 2002

		Depth (replicates)	0m (2)		2m (15)		5m (16)		10m (15)		15m (18)		20m (14)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	car	*Carpoglossum confluens*	10	10	0	0	0	0	0	0	0	0	0	0
	eck	*Ecklonia radiata*	0	0	6.27	5.12	0	0	0	0	0	0	0	0
	hor	*Hormisira banksii*	14	6	0	0	0	0	0	0	0	0	0	0
Algae-green	cha	*Chaetomorpha billardierii*	14	14	0	0	0	0	0	0	0	0	0	0
	ulv	*Ulva* spp.	25	1	0	0	0	0	0	0	0	0	0	0
Total algae			63		6.27		0		0		0		0	
Cnidarians	an1	Anemone, pink solitary	0	0	0	0	0	0	0.27	0.27	1.44	1.02	2.86	2.86
	oct	Common octocoral	0	0	0	0	8.63	4.47	0	0	2.67	0.91	3.14	1.1
	sco	Solitary coral	0	0	0	0	0	0	0	0	0	0	0.14	0.14
	soc	Soft coral	0	0	0	0	23.5	6.72	0.8	0.43	0	0	0	0
	hyd	Hydroids	0	0	0	0	0	0	0.13	0.13	0	0	0	0
Total cnidarians			0		0		32.1		1.2		4.11		6.14	
Sponges	sp1	Sponge 1 Joan Pt 15m.	0	0	0	0	0	0	0	0	0.22	0.15	3.29	0.8
	sp2	Sponge finger, very fine white/grey	0	0	0	0	0	0	0	0	0	0	0.43	0.43
	sp3	Finger sponge 3, fine white/grey	0	0	0	0	1.5	1.26	0	0	0	0	0.43	0.43
	sp6	Tube sponge?	0	0	0	0	0.25	0.25	0	0	0	0	0	0
	spo	Sponge u/i usually flat	0	0	5.6	2.03	2.63	0.83	3.33	1.71	2	0.49	1.86	1.14
Total sponges			0		5.6		4.38		3.33		2.22		6	
Bryozoans	br1	Lace bryozoan 1	0	0	0	0	0	0	0	0	0	0	0.14	0.14
	brf	Lace bryozoan 5	0	0	0	0	0	0	0	0	0.33	0.24	0	0
	brg	Lace Bryozoan 6	0	0	0	0	0	0	0.13	0.13	0	0	0	0
	bru	Lace bryozoan, unidentified	0	0	0	0	0.5	0.22	0	0	0	0	0	0
	bryc	Lace bryozoan 8	0	0	0	0	2.75	2.75	0	0	0	0	0	0
Total bryozoans			0		0		3.25		0.13		0.33		0.14	
Ascidians	as1	Ascidian solitary 1	0	0	0	0	0	0	0	0	0.33	0.33	0.14	0.14
	wta	White throated ascidian	0	0	0	0	0	0	0	0	0.33	0.33	0	0
Molluscs	bra	Ark shell (*Barbatia pistachia*)	0	0	0	0	0	0	6.4	2.5	0	0	0	0
Echinoderms	gon	*Goniocidaris tubaria*	0	0	0	0	0	0	0	0	0	0	0.29	0.29
	toa	*Tosia australis*	0	0	0	0	0.25	0.25	0	0	0	0	0	0
Substrate	bre	Bare reef	38	38	82.8	8.01	48.8	8.37	74.9	11.6	92.4	7.64	87.6	3.7
	gra	Gravel	0	0	0	0	0	0	0.53	0.53	0	0	0	0
	grs	Gravel with shells	0	0	0	0	12.5	7.22	13.5	8.51	0	0	0	0
	sgr	Sand/gravel	0	0	0	0	0	0	6.67	6.67	0	0	0	0
Total substrate			38		82.8		61.3		95.6		92.4		87.6	

Appendix Table 42. Quantitative estimates of percentage cover at Farrell Point T1 in 2010

Farrell Point T1																			
					Depth														
					1m		2m		3m		5m		10m		15m		20m		
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	
Algae	Brown algae	Ecklonia radiata	ECK	eck	29.26	15.07	5.30	4.81	0.87	0.87									
	Green algae	Ulva spp.	ULV	uvl	7.61	4.44	20.07	6.15	0.83	0.83									
	Unidentified algae	Unidentified algae - drift	DRIFT	dri					0.40	0.40									
		Unidentified algae - filamentous	FIL	NA			0.40	0.40											
Algae Total					*36.87*	*19.51*	*25.76*	*11.37*	*2.10*	*2.10*									
Ascidians	Colonial ascidians	Ascidian 2 colonial	NB26	NA													0.42	0.42	
		Ascidian 21 lumpy orange	NB17	NA					0.80	0.80									
		Ascidian 5 colonial	NB33	NA													4.29	4.29	
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1											0.80	0.80			
		Ascidian unidentified	ASC	asc											0.80	0.49	0.48	0.48	
Ascidians Total									*0.80*	*0.80*					*1.60*	*1.29*	*5.18*	*5.18*	
Bryozoans	Branching Bryozoans	Adeonellopsis parvipuncta	BRY5	br7									0.40	0.40					
	Plate Bryozoans	Bryozoan 16 plate	NB6	NA							0.81	0.49							
Bryozoans Total											*0.81*	*0.49*	*0.40*	*0.40*					
Cnidarians	Anemone	Anenome 1 - pink solitary	AN1	an1													1.67	1.67	
	Hydroids	Hydroid 1	HYD1	hyd							2.45	1.50							
		Ralpharia	RAL	NA							0.41	0.41							
	Soft corals	Capnella spp. - brown	CAPB	socb					3.91	3.91									
		Capnella spp. - yellow	CAPY	socy					51.60	4.26	19.81	5.62					1.79	1.10	
		Clavularia spp. - white	CLAV	oc2							13.28	9.08					0.42	0.42	
	Solitary coral	Solitary coral 1	COR	sco													0.89	0.89	
Cnidarians Total									*55.51*	*8.17*	*35.95*	*16.61*					*4.76*	*4.07*	
Echinoderms	Urchins	Goniocidaris tubaria	GON	gon													0.41	0.41	
Echinoderms Total																	*0.41*	*0.41*	
Other Cover	Other Cover	Algal turf	TURF	NA	30.56	10.80	3.60	1.83	1.62	0.75									
		Algal/Hydroid/Silt matrix	AHS	NA			51.75	6.56	0.80	0.80									
		Biogenic Matrix	MATR	NA			1.62	0.99	29.25	6.35	4.47	2.08	2.02	1.12	2.00	2.00	6.73	2.34	
		Fine hydroid/bryozoan layer	BREB	breb					4.58	4.58	44.15	4.92	40.56	4.10	44.15	7.42	77.45	5.42	
Other Cover Total					*30.56*	*10.80*	*56.96*	*9.38*	*36.25*	*12.49*	*48.61*	*7.01*	*42.58*	*5.22*	*46.15*	*9.42*	*84.17*	*7.75*	
Polychaetes	Polychaetes	Galeolaria sp.	GAL	gal					0.80	0.80	0.82	0.50							
		Serpulid	SER	NA											0.80	0.49			
Polychaetes Total									*0.80*	*0.80*	*0.82*	*0.50*			*0.80*	*0.49*			
Sponges	Arborescent sponges	Arborescent sponges	-	-			0.40	0.40									0.42	0.42	
	Encrusting sponges	Encrusting sponges	-	-					0.82	0.50							2.47	1.52	
	Massive sponges	Massive sponges	-	-													1.74	0.78	
	Tubular sponge	Tubular sponge	-	-													0.41	0.41	
Sponges Total							*0.40*	*0.40*	*0.82*	*0.50*							*5.04*	*3.12*	
Substrate	Substrate	Cobble	COB	cob	32.57	3.66	6.42	3.97			1.22	0.50	0.82	0.82	1.60	0.98			
		Gravel	GRA	gra			6.85	1.89	1.25	1.25	2.03	1.12	52.54	6.33	49.05	8.74	0.44	0.44	
		Sand	SAND	san					0.87	0.87	10.56	2.82	3.26	2.78					
		Shells	SHELL	NA			3.61	1.32	1.60	1.17			0.41	0.41	0.80	0.80			
Substrate Total					*32.57*	*3.66*	*16.87*	*7.18*	*3.72*	*3.29*	*13.81*	*4.44*	*57.02*	*10.34*	*51.45*	*10.52*	*0.44*	*0.44*	
Unscorable	Unscorable	unscorable	UNS	NA	0.40	0.40	0.40	0.40	2.40	1.60	1.20	0.49	0.40	0.40	0.40	0.40	7.20	2.58	
Unscorable Total					*0.40*	*0.40*	*0.40*	*0.40*	*2.40*	*1.60*	*1.20*	*0.49*	*0.40*	*0.40*	*0.40*	*0.40*	*7.20*	*2.58*	
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		

Appendix Table 43. Quantitative estimates of percentage cover at Farrell Point T2 in 2010

Farrell Point T2																			
					Depth														
					1m		**2m**		**3m**		**5m**		**10m**		**15m**		**20m**		
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	
Algae	Green algae	Algal Mat Green	AMG	NA			0.40	0.40	0.42	0.42									
		Codium spp.	COD	cos	0.40	0.40													
		Ulva spp.	ULV	uvl			2.40	1.60											
	Unidentified algae	Unidentified algae - drift	DRIFT	dri			0.40	0.40											
Algae Total					*0.40*	*0.40*	*3.20*	*2.40*	*0.42*	*0.42*									
Ascidians	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1													1.22	0.82	
		Ascidian unidentified	ASC	asc													0.43	0.43	
Ascidians Total																	*1.65*	*1.24*	
Bivalves	Scollop	saucer scollop	SCA	NA			0.82	0.82											
Bivalves Total							*0.82*	*0.82*											
Bryozoans	Lace Bryozoans	Bryozoan 6 lace	BRY6	br1													0.82	0.82	
Bryozoans Total																	*0.82*	*0.82*	
Other Cover	Other Cover	Algal turf	TURF	NA	8.40	4.75	0.80	0.80	0.42	0.42									
		Algal/Hydroid/Silt matrix	AHS	NA	81.20	5.43	87.92	4.89	72.07	4.01									
		Biogenic Matrix	MATR	NA					0.40	0.40	6.47	1.95			1.24	0.83	2.06	0.65	
		Fine hydroid/bryozoan layer	BREB	breb							85.83	0.64	71.36	7.43	37.57	5.27	83.86	3.56	
Other Cover Total					*89.60*	*10.18*	*88.72*	*5.69*	*72.89*	*4.83*	*92.30*	*2.59*	*71.36*	*7.43*	*38.82*	*6.10*	*85.91*	*4.21*	
Polychaetes	Polychaetes	Galeolaria sp.	GAL	gal					1.63	1.63	5.25	1.97							
		Serpulid	SER	NA													0.82	0.50	
Polychaetes Total									*1.63*	*1.63*	*5.25*	*1.97*					*0.82*	*0.50*	
Substrate	Substrate	Cobble	COB	cob	4.80	2.24	1.62	0.99	4.92	2.09	2.45	2.45	1.25	0.82					
		Gravel	GRA	gra	5.20	1.50	3.22	2.07	18.91	5.64			24.87	7.38	60.37	6.04	10.80	3.84	
		Reef	BRE	bre									0.82	0.50					
		Shells	SHELL	NA			2.42	1.17	1.23	0.50			1.70	0.82	0.82	0.50			
Substrate Total					*10.00*	*3.74*	*7.27*	*4.23*	*25.06*	*8.23*	*2.45*	*2.45*	*28.64*	*9.52*	*61.18*	*6.54*	*10.80*	*3.84*	
Unscorable	Unscorable	unscorable	UNS	NA			0.80	0.49	2.40	1.17	1.20	0.80	4.40	1.94	2.00	0.63	3.60	0.98	
Unscorable Total							*0.80*	*0.49*	*2.40*	*1.17*	*1.20*	*0.80*	*4.40*	*1.94*	*2.00*	*0.63*	*3.60*	*0.98*	
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		

Appendix Table 44. Quantitative estimates of percentage cover at Eve Point T3 in 2010

Eve Point T3																	
					Depth												
					0.5m		1m		2m		5m		10m		15m		20m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Hormisira banksii	HOR	hor	63.74	6.65	0.23	0.23										
	Green algae	Algal Mat Green	AMG	NA			1.07	0.63	1.16	0.69								
		Codium spp.	COD	cos			0.29	0.29										
		Filamentous green algae	FILG	filg			0.27	0.27										
		Ulva spp.	ULV	uvl			1.50	1.04										
	Unidentified algae	Unidentified algae	UNA	unka											0.40	0.40		
		Unidentified algae - filamentou	FIL	NA			2.09	1.02	1.71	1.02								
		Unidentified algae - foliose	FOL	NA											0.43	0.43		
Algae Total					*63.74*	*6.65*	*5.45*	*3.47*	*2.87*	*1.71*					*0.83*	*0.83*		
Ascidians	Colonial ascidians	Ascidian 12 colonial	NB60	NA											6.10	4.30		
	Solitary ascidians	Ascidian unidentified	ASC	asc									0.40	0.40				
		Herdmania grandis	AS2	rta			0.20	0.20	33.10	9.02								
Ascidians Total							*0.20*	*0.20*	*33.10*	*9.02*			*0.40*	*0.40*	*6.10*	*4.30*		
Bivalves	Mussels bivalve	Mytilus edulis	MYT	myt	1.67	1.03	15.50	5.20										
	Scollop	saucer scollop	SCA	NA					0.22	0.22								
Bivalves Total					*1.67*	*1.03*	*15.50*	*5.20*	*0.22*	*0.22*								
Bryozoans	Lace Bryozoans	Bryozoan 6 lace	BRY6	br1									0.40	0.40				
Bryozoans Total													*0.40*	*0.40*				
Cnidarians	Anemone	Anenome 1 - pink solitary	AN1	an1									2.23	1.31	8.15	4.21	7.50	6.51
	Encrusting octocorals	Erythropodium hicksoni	OCT	oct											6.93	3.78		
	Soft corals	Capnella spp. - yellow	CAPY	socy							70.80	8.24	2.14	1.61	12.48	4.13	11.10	4.08
		Clavularia spp. - white	CLAV	oc2									5.31	1.31			1.20	1.20
	Solitary coral	Solitary coral 1	COR	sco									4.59	1.32	2.03	1.10	3.29	2.11
Cnidarians Total											*70.80*	*8.24*	*14.27*	*5.55*	*29.60*	*13.22*	*23.09*	*13.89*
Other Cover	Other Cover	Algal turf	TURF	NA	28.59	7.79	8.54	8.54										
		Algal/Hydroid/Silt matrix	AHS	NA	1.40	1.40	66.11	9.20	57.63	9.21								
		Biogenic Matrix	MATR	NA			0.20	0.20			8.72	3.19	5.31	2.21	47.74	5.56	13.22	6.07
		Fine hydroid/bryozoan layer	BREB	breb							11.17	3.25	69.73	2.78	13.70	7.66	55.06	12.87
Other Cover Total					*29.98*	*9.19*	*74.85*	*17.94*	*57.63*	*9.21*	*19.89*	*6.44*	*75.04*	*5.00*	*61.44*	*13.22*	*68.29*	*18.94*
Polychaetes	Polychaetes	Serpulid	SER	NA									0.42	0.42			0.42	0.42
Polychaetes Total													*0.42*	*0.42*			*0.42*	*0.42*

Continued on next page…

Appendix Table 44 *continued*. Quantitative estimates of percentage cover at Eve Point T3 in 2010

Eve Point T3 *continued*																	
					Depth												
					0.5m		**1m**		**2m**		**5m**		**10m**		**15m**		**20m**	
Class	**Group**	**Classification**	**2010 code**	**2002 code**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Sponges	Encrusting sponges	Encrusting sponges	-	-			2.06	2.06	0.26	0.26							0.83	0.83
	Globular sponges	Globular sponges	-	-							0.43	0.43						
	Massive sponges	Massive sponges	-	-			0.86	0.86							1.20	1.20		
	Papillate sponge	Papillate sponge	-	-													5.74	4.25
	Tubular sponge	Tubular sponge	-	-													0.41	0.41
Sponges Total							*2.92*	*2.92*	*0.26*	*0.26*	*0.43*	*0.43*			*1.20*	*1.20*	*6.98*	*5.49*
Substrate	Substrate	Cobble	COB	cob			0.59	0.59										
		Gravel	GRA	gra					3.78	3.52			4.57	3.12				
		Reef	BRE	bre	4.61	2.63			0.70	0.50								
		Rubble	BRUB	NA									0.82	0.50				
		Sand	SAND	san							7.28	6.20	1.60	1.17	0.83	0.83		
		Shells	SHELL	NA			0.49	0.34	1.43	0.53	1.60	1.60	2.49	0.74			1.22	1.22
Substrate Total					*4.61*	*2.63*	*1.08*	*0.93*	*5.91*	*4.55*	*8.88*	*7.80*	*9.48*	*5.53*	*0.83*	*0.83*	*1.22*	*1.22*
Unscorable	Unscorable	unscorable	UNS	NA	26.40	6.88	12.60	4.15	7.56	3.40	7.20	1.85	4.00	3.10	2.80	1.20	2.40	0.75
Unscorable Total					*26.40*	*6.88*	*12.60*	*4.15*	*7.56*	*3.40*	*7.20*	*1.85*	*4.00*	*3.10*	*2.80*	*1.20*	*2.40*	*0.75*
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 45. Quantitative estimates of percentage cover at Eve Point T3 in 2002

		Depth (replicates)	0.5m (4)		1m (5)		2m (14)		5m (16)		10m (18)		15m (17)		20m (20)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	eck	*Ecklonia radiata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	hor	*Hormisira banksii*	32	4.83	0	0	0	0	0	0	0	0	0	0	0	0
	ulv	*Ulva* sp.	39.5	2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total algae			71.5	0	0	0	0	0	0	0	0	0	0	0	0	0
Cnidarians	oct	Common octocoral	0	0	0	0	0	0	0	0	6	0.47	1.47	0.28	1.3	0.92
	an1	Anemone, pink solitary	0	0	0	0	0	0	0	0	3.78	0.59	14.4	0.73	4.9	2.23
	oc2	Octocoral species 2, elongate	0	0	0	0	0	0	0	0	0	0	0	0	1.8	1.31
	sco	Solitary coral	0	0	0	0	0	0	0	0	0	0	0.4	0.05	0	0
	soc	Soft coral	0	0	0	0	0	0	48.6	4.88	0	0	11.9	0.73	11.7	1.75
	hyd	Hydroids	0	0	0	0	0	0	0	0	0	0	0	0	7.1	3.3
Total cnidarians			0	0	0	0	0	0	48.6	0	9.78	0	28.1	0	26.8	0
Sponges	sp12	Sponge, large grey	0	0	0	0	0	0	0	0	0	0	0.67	0.15	0	0
	sp20	Sponge massive cream hairy	0	0	0	0	0	0	0	0	0	0	1.6	0.26	0.5	0.5
	spo	Sponge u/i usually flat	0	0	0	0	0	0	1.38	0.6	0.22	0.05	14.5	0.62	12.4	2.09
Total sponges			0	0	0	0	0	0	1.38	0	0.22	0	16.8	0	12.9	0
Bryozoans	bryc	Lace bryozoan 8	0	0	0	0	0	0	0	0	0	0	3.73	0.85	0	0
Ascidians	wta	White throated ascidian	0	0	0	0	0	0	0	0	0.33	0.06	0	0	0	0
	as11	Stalked ascidian solitary	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1
	as7	Colonial ascidian 4 shiny white	0	0	0	0	0	0	0	0	0	0	0.13	0.03	0	0
Molluscs	bra	Ark shell (*Barbatia pistachia*)	0	0	0	0	0	0	0	0	27.2	1.2	0.93	0.18	0	0
	myt	*Mytilus edulis*	11.5	3.86	1.2	0.8	5.43	1.53	0	0	0	0	0	0	0	0
Echinoderms	gon	*Goniocidaris tubaria*	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0.3
	sti	*Stichopus mollis*	0	0	0	0	0	0	0	0	0.22	0.05	0	0	0	0
	tom	*Tosia magnifica*	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.2
Other cover	breb	Fine hydroid/bryozoan layer	0	0	0	0	0	0	0	0	0	0	0	0	9.4	3.29
Cover	bre	Bare reef	16	5.23	98.8	0.8	94.6	1.53	49.8	4.98	58	1	50.3	1.04	57.6	4.24
	grs	Gravel with shells	0	0	0	0	0	0	0	0	4	0.41	0	0	0	0
Total cover			16		98.8		94.6		49.8		62		50.3		57.6	

Appendix Table 46. Quantitative estimates of percentage cover at Eve Point T4 in 2010

Eve Point T4																	
					Depth												
					0.5m		1m		2m		5m		10m		15m		20m	
Class	Group	Classification	2010 code	2002 code	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Hormisira banksii	HOR	hor	17.85	7.14												
	Green algae	Codium spp.	COD	cos	0.42	0.42												
		Filamentous green algae	FILG	filg			18.29	9.36	0.84	0.62								
		Ulva spp.	ULV	uvl	2.42	1.48	29.03	5.68	13.68	3.12								
	Red algae	Peyssonnelia spp.	PEY	pey					0.31	0.31								
	Unidentified algae	Unidentified algae - filamentous	FIL	NA			11.23	5.07	0.86	0.43								
Algae Total					*20.69*	*9.04*	*58.55*	*20.11*	*15.69*	*4.48*								
Ascidians	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1									0.41	0.41	1.36	0.55		
		Ascidian unidentified	ASC	asc													0.48	0.48
		Herdmania grandis	AS2	rta					3.83	0.69	0.51	0.51						
Ascidians Total									*3.83*	*0.69*	*0.51*	*0.51*	*0.41*	*0.41*	*1.36*	*0.55*	*0.48*	*0.48*
Crustacea	Barnacles	Barnacles	BAR	bra			0.26	0.26	21.41	3.30								
Bivalves	Mussels bivalve	Mytilus edulis	MYT	myt	4.83	1.87	8.63	2.25	3.00	0.96								
Bivalves Total					*4.83*	*1.87*	8.63	2.25	3.00	0.96								
Bryozoans	Branching Bryozoans	Adeonellopsis parvipuncta	BRY5	br7									0.43	0.43				
		Bryozoan 12 Caberea like	BRY12	NA									0.43	0.43				
		Bryozoan 4 branching	BRY4	br6			0.54	0.54										
Bryozoans Total							*0.54*	*0.54*					*0.86*	*0.86*				
Cnidarians	Anemone	Anenome 1 - pink solitary	AN1	an1													0.54	0.54
	Hydroids	Hydroid 1	HYD1	hyd							8.13	5.35						
	Soft corals	Capnella spp. - yellow	CAPY	socy							46.68	17.52	0.83	0.51	10.84	3.35	6.11	1.99
		Clavularia spp. - white	CLAV	oc2							18.22	11.35			2.79	2.79		
	Solitary coral	Solitary coral 1	COR	sco									1.65	1.01				
Cnidarians Total											*73.03*	*34.21*	*2.49*	*1.52*	*13.63*	*6.14*	*6.65*	*2.53*
Other Cover	Other Cover	Algal turf	TURF	NA	40.52	4.04	9.23	3.29	23.79	7.17								
		Algal/Hydroid/Silt matrix	AHS	NA			7.19	3.67										
		Biogenic Matrix	MATR	NA	20.58	6.95	11.89	6.32	1.34	0.90	25.11	3.75	71.95	4.71	69.61	6.71	78.10	2.86
		Fine hydroid/bryozoan layer	BREB	breb									0.44	0.44				
Other Cover Total					*61.10*	*10.98*	*28.31*	*13.28*	*25.14*	*8.07*	*25.11*	*3.75*	*72.40*	*5.15*	*69.61*	*6.71*	*78.10*	*2.86*
Polychaetes	Polychaetes	Galeolaria sp.	GAL	gal					0.91	0.64								
		Serpulid	SER	NA													0.63	0.63
Polychaetes Total									*0.91*	*0.64*							*0.63*	*0.63*
Sponges	Encrusting sponges	Encrusting sponges	-	-			2.09	1.05	16.25	3.41					0.67	0.67	0.50	0.50
	Lumpy sponges	Lumpy sponges	-	-											0.56	0.56	0.63	0.63
	Massive sponges	Massive sponges	-	-											0.98	0.61		
	Tubular sponge	Tubular sponge	-	-													1.21	1.21
Sponges Total							*2.09*	*1.05*	*16.25*	*3.41*					*2.20*	*1.83*	*2.34*	*2.34*
Substrate	Substrate	Gravel	GRA	gra					1.42	1.42								
		Reef	BRE	bre	13.37	2.19			2.61	1.17								
		Rubble	BRUB	NA											0.47	0.47		
		Sand	SAND	san									3.82	1.82	2.51	1.55	7.29	2.10
		Shells	SHELL	NA			1.62	1.20	9.75	5.70	1.35	0.92	20.03	4.79	10.23	7.66	4.52	2.80
Substrate Total					*13.37*	*2.19*	*1.62*	*1.20*	*13.79*	*8.30*	*1.35*	*0.92*	*23.85*	*6.61*	*13.20*	*9.68*	*11.82*	*4.90*
Unscorable	Unscorable	unscorable	UNS	NA	1.20	0.80	20.20	3.56	18.67	2.98	12.00	3.90	5.20	1.85	20.40	6.05	26.40	3.87
Unscorable Total					*1.20*	*0.80*	*20.20*	*3.56*	*18.67*	*2.98*	*12.00*	*3.90*	*5.20*	*1.85*	*20.40*	*6.05*	*26.40*	*3.87*
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*	

Appendix Table 47. Quantitative estimates of percentage cover at Eve Point T4 in 2002

		Depth (replicates)	0.5m (6)		2m (20)		5m (18)		7m (21)		10m (15)		15m (16)		20m (16)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	bro	Brown algae unidentified	10	4.82	0	0	0	0	0	0	0	0	0	0	0	0
	fbr	Fillamentous browns	16.7	6.57	0	0	0	0	0	0	0	0	0	0	0	0
	hor	*Hormisira banksii*	48.3	5.1	0	0	0	0	0	0	0	0	0	0	0	0
Algae-green	ulv	*Ulva* spp.	39	8.29	0	0	0	0	0	0	0	0	0	0	0	0
Total algae			114		0		0		0		0		0		0	
Cnidarians	oct	Common octocoral	0	0	0	0	2.35	2.29	0	0	0.27	0.27	0.88	0.75	1.5	0.85
	an1	Anemone, pink solitary	0	0	0	0	0	0	2.11	1.34	19.9	8.24	0	0	2.88	1.03
	sco	Solitary coral	0	0	0	0	0	0	0	0	0	0	0.25	0.25	0.88	0.41
	soc	Soft coral	0	0	0	0	26.2	4.52	6.11	2.25	0	0	1	0.55	0.5	0.29
Total cnidarians			0		0		28.6		8.2		20.1		2.13		5.76	
Sponges	cus	Cup sponge	0	0	0	0	0	0	0.11	0.1	0	0	0	0	0	0
	sp17	Sponge massive white-grey	0	0	0	0	0	0	0	0	0	0	0	0	0.88	0.88
	sp18	Sponge grey massive	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0.25
	sp19	Sponge cream upright block	0	0	0	0	0	0	0	0	0	0	1.38	0.79	0.5	0.29
	sp20	Sponge massive cream hairy	0	0	0	0	0	0	0	0	0	0	0	0	0.63	0.44
	spo	Sponge u/i usually flat	0	0	2.5	1.83	2.12	0.63	1	0.34	1.07	0.47	3.25	0.85	6	1.55
Total sponges			0		2.5		2.12		1.11		1.07		4.63		8.25	
Bryozoans	br7	Branching bryozoan 2	0	0	0	0	0.47	0.46	2.78	1.24	0	0	0	0	0	0
	brb	Lace bryozoan 7	0	0	0	0	0	0	0.22	0.21	0	0	0	0	0	0
	bry	Lace bryozoan, unidentified	0	0	0	0	0.59	0.57	0.33	0.31	0	0	0	0	0	0
	bryc	Lace bryozoan 8	0	0	0	0	1.65	1.6	11.11	4.57	0	0	0	0	0	0
Total bryozoans			0		0		2.71		14.44		0		0		0	
Ascidians	asc	Ascidian u/I	0	0	2.3	2.3	0	0	0	0	0	0	0	0	0	0
	wta	White throated ascidian	0	0	0	0	0	0	0	0	0.13	0.13	0	0	0	0
Molluscs	bra	Ark shell (*Barbatia pistachia*)	0	0	0	0	2.94	1.63	2	1.36	21.7	5.99	28.5	8.7	2.63	2.15
	myt	*Mytilus edulis*	0.33	0.33	11.9	3.27	0	0	0	0	0	0	0	0	0	0
Annelids	gal	*Galiolaria* sp.	0	0	14.7	5.97	19.5	7.34	29	7.19	0	0	0	0	0	0
Echinoderms	gon	*Goniocidaris tubaria*	0	0	0	0	0	0	0	0	0	0	0.63	0.35	0.25	0.25
	tom	*Tosia magnifica*	0	0	0	0	0	0	0.22	0.21	0	0	0	0	0.13	0.13
Other cover	epi	Fine hydroid/bryozoan layer	0	0	0	0	0	0	0	0	0	0	0.75	0.75	0	0
	uid	Unidentified cover	2.33	2.33	0	0	0	0	0	0	0	0	3	2.08	1.25	1.25
Substrate	bre	Bare reef	3.67	1.82	65.7	5.52	41.8	3.49	44.3	4.64	42.3	6.75	56.1	7.51	79.9	2.21
	gra	Gravel	0	0	0	0	2	1.94	0	0	2.27	2.27	0	0	0	0
	grs	Gravel with shells	0	0	0	0	0.94	0.91	1.67	1.54	10.4	3.83	0	0	1.5	1.04
	san	Sand	0	0	0	0	0	0	0	0	0.27	0.27	0	0	0	0
	sgr	Sand/gravel	0	0	0	0	0	0	0	0	0	0	3.63	2.61	0	0
	she	Shells	0	0	2.9	1.51	1.06	1.03	0	0	1.73	1.73	0	0	0	0
Total substrate			3.67		68.6		45.8		46		56.9		59.8		81.4	

Appendix Table 48. Quantitative estimates of percentage cover at the Point east of Eve Point T1 in 2010

Point East of Eve Point T1																			
					Depth														
					0.5m		1m		2m		5m		10m		15m		20m		
Class	Group	Classification	2010 code	2002 co	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	
Algae	Green algae	Algal Mat Green	AMG	NA			14.00	4.90	14.43	2.29									
	Unidentified algae	Unidentified algae - drift	DRIFT	dri	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40							
		Unidentified algae - filamentous	FIL	NA			4.40	4.40											
Algae Sum					*0.40*	*0.40*	*18.80*	*9.70*	*14.83*	*2.69*	*0.40*	*0.40*							
Ascidians	Encrusting ascidiar	Ascidian 14 encrusting	NB62	NA													0.91	0.91	
	Solitary ascidians	Ascidian 1 solitary (cf Stolonica spp.)	AS1	as1											1.25	0.85	2.16	0.96	
		Ascidian unidentified	ASC	asc											1.23	0.50	0.45	0.45	
		Herdmania grandis	AS2	rta					0.40	0.40									
Ascidians Sum									*0.40*	*0.40*					*2.48*	*1.35*	*3.53*	*2.32*	
Bryozoans	Branching Bryozoa	Adeonellopsis parvipuncta	BRY5	br7									0.40	0.40					
		Hornea robusta	BRY3	br5													0.40	0.40	
	Lace Bryozoans	Bryozoan 10 lace	BRY10	brb									0.80	0.49					
		Bryozoan 11 lace	BRY11	bryc											0.40	0.40			
Bryozoans Sum													*1.20*	*0.89*	*0.40*	*0.40*	*0.40*	*0.40*	
Cnidarians	Anemone	Anemone 3 - elongate pink/white	AN3	an3									4.41	1.94					
		Anenome 1 - pink solitary	AN1	an1													0.91	0.91	
	Hydroids	Hydroid 1	HYD1	hyd											0.85	0.53			
		Ralpharia	RAL	NA													0.40	0.40	
	Soft corals	Capnella spp. - yellow	CAPY	socy							15.16	14.18			3.41	1.15	3.02	1.14	
		Clavularia spp. - white	CLAV	oc2									0.41	0.41					
	Solitary coral	Solitary coral 1	COR	sco											0.40	0.40			
Cnidarians Sum											*15.16*	*14.18*	*4.82*	*2.34*	*4.67*	*2.07*	*4.33*	*2.45*	
Echinoderms	Urchins	Goniocidaris tubaria	GON	gon									0.41	0.41					
Echinoderms Sum													*0.41*	*0.41*					
Other Cover	Other Cover	Algal/Hydroid/Silt matrix	AHS	NA	99.20	0.49	81.20	4.84	79.57	4.24									
		Biogenic Matrix	MATR	NA											0.40	0.40			
		Fine hydroid/bryozoan layer	BREB	breb							45.82	12.00	31.91	14.41	84.25	3.87	77.07	3.35	
Other Cover Sum					*99.20*	*0.49*	*81.20*	*4.84*	*79.57*	*4.24*	*45.82*	*12.00*	*31.91*	*14.41*	*84.65*	*4.27*	*77.07*	*3.35*	
Polychaetes	Polychaetes	Serpulid	SER	NA											0.43	0.43	0.40	0.40	
Polychaetes Sum															*0.43*	*0.43*	*0.40*	*0.40*	
Sponges	Tubular sponge	Tubular sponge	-	-													0.40	0.40	
Sponges Sum																	*0.40*	*0.40*	
Substrate	Substrate	Gravel	GRA	gra	0.40	0.40					1.03	1.03	2.45	2.45			3.87	1.27	
		Reef	BRE	bre							0.40	0.40							
		Rubble	BRUB	NA									2.00	2.00					
		Sand	SAND	san					0.40	0.40	33.20	13.71	56.02	16.62	4.00	2.76			
		Shells	SHELL	NA					0.80	0.49	4.00	2.76	1.20	0.80	0.40	0.40	0.40	0.40	
		Silt	SILT	sed					4.00	3.03					2.98	2.98	9.60	6.40	
Substrate Sum					*0.40*	*0.40*			*5.20*	*3.92*	*38.63*	*17.89*	*61.67*	*21.87*	*7.38*	*6.14*	*13.87*	*8.07*	
Unscorable	Unscorable	unscorable	UNS	NA					0.40	0.40	4.40	4.40	0.40	0.40	3.60	2.40	4.80	2.94	
Unscorable Sum									*0.40*	*0.40*	*4.40*	*4.40*	*0.40*	*0.40*	*3.60*	*2.40*	*4.80*	*2.94*	
Grand total					*100*		*100*		*100*		*100*		*100*		*100*		*100*		

Appendix Table 49. Quantitative estimates of percentage cover at the Point east of Eve Point T1 in 2002

		Depth (replicates)	0.5m (6)		1m (10)		2m (5)		5m (14)		7m (15)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	hor	*Hormisira banksii*	6.33	4.08	0	0	0	0	0	0	0	0
Algae-green	fgr	Fillamentous greens	5.67	4.01	0	0	0	0	0	0	0	0
	ulv	*Ulva* spp.	0.67	0.67	0	0	0	0	0	0	0	0
Total algae			12.7		0		0		0		0	
Sponges	spo	Sponge u/i usually flat	0	0	0	0	0	0	0.71	0.4	0.53	0.36
Molluscs	myt	*Mytilus edulis*	0	0	2.4	5.64	0	0	0	0	0	0
Annelids	gal	*Galiolaria* sp.	0	0	0	0	0	0	5.43	2.61	0.8	0.55
Substrate	bre	Bare reef	57	9.41	75.2	36.4	98.8	1.2	82.3	8.2	20.9	9.88
	grs	Gravel with shells	12	12	7.4	17	0	0	0	0	66.4	12.6
	san	Sand	18.3	10.9	15	31.9	0	0	0	0	0	0
	sed	Sediment, usually fine	0	0	0	0	1.2	1.2	11.4	8.04	11.3	7.86
Total substrate			87.3		97.6		100		93.7		98.7	

Appendix Table 50. Quantitative estimates of percentage cover at the Platypus Point T1 in 2010

Platypus Point T1																	
					Depth												
					0.5m		1m		2m		5m		10m		15m		20m	
Class	Group	Classification	2010 co	2002 co	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae	Brown algae	Hormisira banksii	HOR	hor					0.40	0.40	0.80	0.49						
		Sporochnus sp.	SPO	spo			13.72	4.92										
	Green algae	Algal Mat Green	AMG	NA			1.72	1.22	16.80	3.01	1.20	0.80						
	Red algae	Foliose red algae	FORE	fore			0.43	0.43										
	Unidentified algae	Unidentified algae - drift	DRIFT	dri			0.94	0.58	1.60	1.60							0.80	0.80
		Unidentified algae - filan	FIL	NA	8.00	4.60	5.46	2.61									0.40	0.40
Algae Total					*8.00*	*4.60*	*22.26*	*9.76*	*18.80*	*5.01*	*2.00*	*1.29*					*1.20*	*1.20*
Ascidians	Colonial ascidians	Ascidian 12 colonial	NB60	NA													0.40	0.40
	Solitary ascidians	Ascidian 1 solitary (cf Sto	AS1	as1					0.40	0.40								
		Ascidian unidentified	ASC	asc											0.40	0.40		
		Herdmania grandis	AS2	rta					0.40	0.40								
Ascidians Total									*0.80*	*0.80*					*0.40*	*0.40*	*0.40*	*0.40*
Bivalves	Bivavles	Barbatia pistachio (Ark sl	BAR	bra			0.47	0.47										
	Mussels bivalve	Mytilus edulis	MYT	myt			1.33	1.33										
Bivalves Total							*1.80*	*1.80*										
Bryozoans	Branching Bryozoans	Bryozoan 12 Caberea like	BRY12	NA									1.21	0.49	0.43	0.43	0.81	0.49
		Bryozoan 13 Caberea like	BRY13	NA													0.40	0.40
Bryozoans Total													*1.21*	*0.49*	*0.43*	*0.43*	*1.21*	*0.89*
Cnidarians	Anemone	Anemone 2 – common tu	AN2	an2													1.22	1.22
	Hydroids	Hydroid 1	HYD1	hyd					0.40	0.40								
	Soft corals	Capnella spp. - brown	CAPB	socb							0.40	0.40						
		Capnella spp. - yellow	CAPY	socy							18.47	5.84	3.60	1.94				
	Solitary coral	Solitary coral 1	COR	sco											5.70	3.02	0.41	0.41
Cnidarians Total									*0.40*	*0.40*	*18.87*	*6.24*	*3.60*	*1.94*	*5.70*	*3.02*	*1.63*	*1.63*
Echiurans	Echiurans	Echiuran 1 unidentified	NB69	NA													0.40	0.40
Echiurans Total																	*0.40*	*0.40*
Other Cover	Other Cover	Algal/Hydroid/Silt matrix	AHS	NA	89.60	4.45	58.45	15.17	2.00	1.55	0.40	0.40						
		Biogenic Matrix	MATR	NA									4.01	3.52				
		Fine hydroid/bryozoan la	BREB	breb					62.40	8.57	50.64	6.41	8.05	1.14	29.07	15.19	39.73	9.94
Other Cover Total					*89.60*		*58.45*		*64.40*		*51.04*		*12.06*		*29.07*		*39.73*	
Polychaetes	Polychaetes	Galeolaria sp.	GAL	gal							1.21	0.80						
		Serpulid	SER	NA											0.80	0.49	0.41	0.41
Polychaetes Total											*1.21*				*0.80*		*0.41*	
Sponges	Encrusting sponges	Encrusting sponges	-	-			4.61	3.60	0.40	0.40								
Sponges Total							*4.61*		*0.40*									
Substrate	Substrate	Cobble	COB	cob	1.60	0.98	2.65	2.06	0.40	0.40	0.40	0.40						
		Gravel	GRA	gra	0.80	0.80					0.40	0.40						
		Reef	BRE	bre					0.40	0.40	0.41	0.41						
		Rubble	BRUB	NA									0.40	0.40	1.60	1.60	1.21	0.49
		Sand	SAND	san							4.07	3.59	6.87	3.88	44.40	18.59	51.40	10.84
		Shells	SHELL	NA					0.40	0.40	19.61	12.38	3.20	2.24	2.40	1.47	2.42	0.76
		Silt	SILT	sed			10.23	10.23	14.00	9.51	2.00	2.00	72.66	5.47	15.20	15.20		
Substrate Total					*2.40*		*12.89*		*15.20*		*26.89*		*83.13*		*63.60*		*55.02*	
Unscorable	Unscorable	unscorable	UNS	NA			11.60	3.54			0.40	0.40	0.40	0.40	1.20	1.20	0.40	0.40
Unscorable Total							*11.60*				*0.40*		*0.40*		*1.20*		*0.40*	
Total % cover minus 'unscorable'					*100*		*100*		*100*		*100*		*100*		*100*		*100.00*	

Appendix Table 51. Quantitative estimates of percentage cover at the Platypus Point T1 in 2002

		Depth (replicates)	0m (2)		1m (2)		2m (8)		5m (13)		10m (12)		15m (14)		20m (16)		25m (2)	
Cover	Code	Description of species or cover	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
Algae-brown	hor	*Hormisira banksii*	58	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Algae-green	ulv	*Ulva* spp.	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total algae			61		0		0		0		0		0		0		0	
Cnidarians	an1	Anemone, pink solitary	0	0	0	0	0	0	0	0	0.91	0.6	0	0	0	0	0	0
	an3	Anemone, elongate pink-white	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0.25	0	0
	an4	Anemone, elongate pink-white	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0.13	0	0
	sco	Solitary coral	0	0	0	0	0	0	0	0	0.33	0.22	5.57	0.73	4.13	0.29	0	0
	soc	Soft coral	0	0	0	0	0	0	20.2	4.98	0.17	0.17	0	0	0	0	0	0
Total cnidarians	totc		0	0	0	0	0	0	20.2	0	1.41	0	5.57	0	4.5	0	0	0
Sponges	spo	Sponge u/i usually flat	0	0	0	0	0	0	0.77	0.43	0	0	0	0	7.13	5.67	0	0
Total sponges	tots		0	0	0	0	0	0	0.77	0	0	0	0	0	7.13	0	0	0
Bryozoans	br2	Lace bryozoan 2	0	0	0	0	0	0	0.77	0.77	0	0	0	0	0	0	0	0
Total bryozoans	totb		0	0	0	0	0	0	0.77	0	0	0	0	0	0	0	0	0
Molluscs	myt	*Mytilus edulis*	0	0	0	0	34	6.72	0	0	0	0	0	0	0	0	0	0
Annelids	gal	*Galio*l*aria* sp.	0	0	0	0	2	2	13.7	4.3	0	0	0	0	0.63	0.44	0	0
Cover	uid	Unidentified cover	21	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Substrate	bre	Bare reef	18	14	100	0	64	5.45	48.5	10.4	76.2	11.7	56.3	11.5	87.8	5.62	0	0
	gra	Gravel	0	0	0	0	0	0	0	0	8.33	8.33	0	0	0	0	0	0
	grs	Gravel with shells	0	0	0	0	0	0	23.8	5.69	0	0	0	0	0	0	0	0
	san	Sand	0	0	0	0	0	0	0	0	1.67	1.67	0	0	0	0	0	0
	sed	Sediment, usually fine	0	0	0	0	0	0	0	0	14.2	9.73	38.1	11.4	0	0	100	0
Total substrate	totsub		18	0	100	0	64	0	72.3	0	100	0	94.4	0	87.8	0	100	0